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ORIGINAL MEMOIRS.

TETANY FOLLOWING EXTIRPATION OF THE THYROID.*

WITH REPORT OF A CASE.

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BEFORE the function of the parathyroid glands was known, Reverdin and Kocher noticed that symptoms of tetany followed the complete removal of the thyroid gland, but that if a part of the gland was left the patient as a rule escaped tetany and also cachexia strumapriva. Before these observations were published, Billroth had 10 cases of tetany out of 38 thyroidectomies, Reverdin 3 cases out of 17, and Mikulicz reported 3 cases of tetany out of 7 thyroidectomies. It was thought that tetany was due to thyroid removal, and the importance and function of the parathyroids was not established until considerably later and after much experimental work had been done on animals.

The parathyroids were discovered by Sandström, of Upsala, in 1880, and Gley in 1891–1897 proved for the first time by experiments on animals that post-operative tetany was due to the removal of the parathyroids and not to the thyroid. Soon after (in 1896) Vassale also connected tetany with removal of the parathyroids. Benjamins in 1892 first examined the

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thyroids removed in operations for goitre in the human subject. He examined 20 thyroids surgically removed. In nine cases where there were complete clinical histories the parathyroids were found removed with the thyroid in five, in four cases no parathyroids were removed. Of the five cases four developed tetany, of the four not one.

Erdheim did much experimental work on rats, but also examined histologically the neck tissues of three patients dying of tetany. In all three cases, though some thyroid gland was discovered, he failed to find any trace of parathyroids. From post-operative tetany and its supposed cause in the destruction of parathyroids, Jeandelize suggested that other forms of tetany, such as infantile, gastric, etc., were due to disease or insufficiency of the parathyroids, and this theory was accepted by Chvostek. Although most observers reported that complete excision of the parathyroids in dogs, rabbits, and rats proved fatal with few exceptions, Vincent and Jolly, Halpenny and Forsyth held the contrary and reported observations where the thyroids and parathyroids had been completely removed and yet the animals lived, and when killed after many days no trace of parathyroids were found post mortem. Vincent and Jolly said that rats and guinea pigs do not seem to suffer at all as the result of extirpation (*Jour. of Physiol.*, 1904–1906).

However, notwithstanding the observations of the above mentioned, the weight of opinion tends to prove that post-operative tetany is dependent on the removal, or destruction, or injury of the parathyroids. I do not intend to go into the proofs of this contention, for in many papers by MacCallum, Erdheim, Vassale, Generali, Pineles, and others, and in the excellent treatise by Ochsner and Thomson on the "Surgery and Pathology of the Thyroid and Parathyroids," a full account of the experiments may be obtained.

Now there are two theories of the functions of the parathyroids: (1) That an antitoxin is developed by the parathyroids which neutralizes certain waste products of tissue metabolism (Berkeley), so that when the parathyroids are destroyed a toxic material is formed in the blood which causes

tetany. (2) That the calcium metabolism of the cells of the body is controlled by the parathyroids, and that their removal causes a rapid disappearance of the soluble salts of calcium from the blood. This theory was advanced by W. G. MacCallum, who found that calcium lactate injected into the veins of parathyroidectomized dogs immediately resulted in the improvement of the symptoms of tetany and that the dog remained well for twelve hours, when tetany again came on. The effect of the injections becomes less as time goes on and each subsequent injection is less effective and finally the dog dies. The same effect is produced by salts of strontium and magnesium; sodium chloride acts very slowly.

In 1911 Voegtlin and MacCallum (*Jour. of Phar. and Ex. Ther.*, May, 1911) somewhat modified this calcium theory and said: "It is quite evident from these experiments that the introduction of large quantities of salt solution of concentration greater than that of the blood does indeed, as pointed out by Joseph and Meltzer, stop the symptoms of tetany." But they go on to say "that it produces this effect by dulling the excitability of the motor nerves, rendering them insusceptible to the influence of any circulating poisonous substances which may appear as the result of parathyroidectomy, or possibly by affecting some structure of the neuromuscular apparatus peripheral to the point of attack of the poison." That there must be something in the calcium theory is rather favored by the facts stated by Morel (*Compt. Rend. Soc. Bioch.*, 67–780) that fractures in parathyroidectomized animals heal much slower than normal animals, also that parathyroid extract administered to young rabbits favors growth of bone quite independent of the calcium contents of food grains, and Erdheim (*Frankfurter z. Path.*, 175–250) states that after parathyroidectomy the skeleton as a whole takes on changes resembling rickets in young animals and more like osteomalacia when the animals are old. Erdheim (*ibid.*, 238–48) says that in rats after the removal of the parathyroids, the dentine calcifies late or not at all and the enamel is deficient in places, and fractures often result. If parathyroids are transplanted and they take, the dentine rapidly calcifies.

That there is truth in our first hypothesis of a toxic material in the blood produced when the parathyroids are removed or destroyed is evident, for if a dog in tetany be bled and an indifferent salt solution be transfused, the symptoms of tetany are at once relieved by thus reducing the amount of poison circulating in the blood. This does not greatly reduce the hyperexcitability of the motor nerves. Simple bleeding in tetany will also have a beneficial effect.

The idea advanced by the earlier observers that the parathyroids are really embryonic remnants or portions of fetal thyroid has been almost entirely given up, and most observers admit that the parathyroids are organs of vital importance to the economy. There are still some, such as Vincent and Jolly, Forsyth, Kishi, Halpenny, and others, who assert that the parathyroids take the place of the thyroid when that gland is extirpated and that there is thus an intimate relationship between the thyroid and parathyroids, for if the parathyroids be left after thyroidectomy the hypertrophied parathyroids to all intents and purposes become converted into thyroid tissue with vesicles containing colloid, so that it is likely there is some interdependence between the thyroid and parathyroids. The same changes occur in the pituitary body after both thyroidectomy or parathyroidectomy (Herring, Rogowvitsch).

Now as to the recognition of parathyroids during operation on the thyroid in the human subject. This is by no means easy in my experience and I do not think any one can be certain of recognizing positively a parathyroid gland without a microscopical examination. I have removed inadvertently what I thought without doubt was a parathyroid, but it was found to be only a small lymph-gland.

Rulison (*Anatomical Record,* July, 1909) says that after an extensive investigation on the dead human subject only 41 per cent. of the probable parathyroids identified as such by gross inspection actually contained parathyroid tissue when examined microscopically. Rogers and Ferguson, out of 189 supposed parathyroids examined, found that only 61 were true parathyroids. The gross appearance is often misleading. Many of the supposed parathyroids were adenoid or thyroid

tissue. Forsyth, who examined some 59 human subjects, found that most unlikely portions of tissue contained parathyroids, and that much parathyroid tissue was mixed up with supernumerary thyroids or thymic tissue (*Trans. Path. Soc.*, London, 1907). Halpenny has found the same difficulty in animals, not only in recognizing them but in finding them. As a rule, their yellowish-brown color distinguishes them from the deep red of the thyroid.

Treatment of Tetany.—Many measures have been employed. Transfusion of blood, bleeding alone or followed by transfusion of salt solution has prolonged the life of dogs but has not been curative. Improvement occurs for a time and then the dog dies. Parathyroid feeding and injection has been extensively tried in animals but the improvement has been only temporary, and although frequently repeated the animal eventually dies. Beebe (Berkeley and Beebe, *Jour. Med. Res.*, 1909) has prepared a nucleoproteid principle of parathyroid from which he reports good results, and others who have used it speak highly of it. Halsted and Pool report each a case in which tetany has been averted for a considerable period by the frequent hypodermic injections of Beebe's nucleoproteid. The administration of the lactate of calcium has been successful in warding off attacks of tetany. Many cases are reported, but the treatment has to be kept up. In the case I report below calcium lactate was used most successfully in keeping the patient free from attacks.

Transplantation of parathyroids of animals has been tried in tetany following thyroidectomy on the human subject with only a temporary benefit. Autotransplantation appears to be usually successful, while isotransplantation invariably fails. Eiselsberg has reported a case of successful transplantation of parathyroid in a woman forty-two years old who for many years had suffered from tetany. She attended his clinic when a goitre operation was performed and finally a suitable case appeared and one of the parathyroids was transplanted. Kocher transplanted thyroid into the bone marrow of the tibia. In this way in dogs the animal was kept alive, but when the bone containing the transplanted thyroid was resected the

animal died of acute tetany, another proof of the interdependence of thyroid on parathyroid.

W. H. Brown, of Victoria, Australia, reports (ANNALS OF SURGERY, February, 1912) a successful case of autotransplantation of the thyroid in a case of tetany following thyroidectomy. This was a most severe case and was not controlled by implanting the parathyroids of animals, including monkeys, or the taking of fresh parathyroids by the mouth. He also injected parathyroid emulsion. Finally he managed to get some human parathyroids from a patient half an hour after death, and successfully transplanted them into the left rectus abdominis muscle. From that time the patient began to improve and a couple of months later had gained 15 pounds and was perfectly well. Mr. Brown had given lactate of calcium in this case without the least benefit, but when we learn the dose was only ten grains we do not wonder at his want of success.

Isaac Ott reports the temporary cure of tetany after complete parathyroidectomy by the administration of pituitary extract.

Now I have always thought there was little danger of removing all the parathyroids or injuring them in performing total thyroidectomy, for I had in quite a number of cases removed the whole thyroid and in others left only the isthmus or a part of one of the lateral lobes, and I never saw a case of tetany or cachexia strumapriva. However, last January I operated on a case in which I was forced to remove nearly all the thyroid, and this operation was followed by severe tetany. In this case no trace of any parathyroids was found in a most careful examination of the removed gland by Dr. Rhea, the pathologist to the Montreal General Hospital, so we must conclude that the parathyroids were so injured at the operation that they were rendered useless. I thought I recognized the right lower one at the time of operation and studiously avoided injuring it, but it no doubt was something else. The following is an account of the case, which is reported by my house surgeon, Dr. H. H. Hepburn:

Mabel W., aged thirty-four, consulted me on January 2, 1912, for an enlarged neck. She has had a swelling of the neck since thirteen years of age, which has gradually enlarged and latterly somewhat altered her voice; she has frequent attacks of dyspnœa, and difficulty in swallowing is a constant symptom. When lying down she is unable to swallow fluids; has attacks of palpitation at times. Married and has two children, and it was noticed that the swelling in the neck always increased and remained larger during pregnancy. Has frequently reduced the size of the gland by taking thyroid extract. On examination a much enlarged thyroid was found, larger on the right than on the left side. On the right side also was a solid globular mass in front of the sternomastoid the size of a tangerine orange. The left lobe although much smaller than the right seemed to push out the left sternomastoid. The enlarged right lobe extended on the right side above the level of the angle of the jaw. The whole gland was smooth and soft but did not appear to be vascular. No signs of exophthalmic goitre, no tremors, tachycardia, or other signs. On examination of the larynx there was paresis of the right cord and some compression of the third to the fifth rings of the trachea.

The patient has always been a perfectly healthy woman and was normal in every way. She was advised operation and came into the hospital on January 14 and was operated on under general anæsthesia on the fifteenth. I intended to remove the right lobe and isthmus only, but after having freed the enlarged right lobe and left what I thought was a parathyroid at its lower end posteriorly, I found another large tumor below the first, and on examination this proved to be a portion of the left lobe which had pushed its way beneath the trachea and œsophagus and appeared on the right side of the neck. At the point where this portion of the thyroid crossed behind the trachea, the rings of the latter were much atrophied and the trachea was much compressed laterally, the portion above the narrowed trachea was dilated and thinned, and on touching it a noise like squeezing a ping-pong ball was made. This was a condition that at any moment might have resulted in kinking of the trachea and so producing fatal dyspnœa, as in the cases reported by Rose. I freed this part of the thyroid with some difficulty and pushed it to the left side. There I found the lower pole of the left lobe

was much larger than I had thought and went behind the sternum and into the thorax. Not liking to leave so large a piece of gland in such a position I decided to remove it, and tied off the upper horn of the left lobe, leaving a considerable portion of thyroid tissue, then tied the inferior thyroid artery, and pulled up the lower part projecting into the thorax. In doing so I looked carefully for parathyroids but failed to find any. I then cut off a piece the size of half a large egg which lodged under the sternomastoid and was still connected with its bed by connective tissue, and left it there, the whole of the rest of the gland coming away together in one piece.

The operation was rather prolonged, but the patient had stood it well and was in first-rate condition. A tube was introduced and the wound closed. Next day there seemed to be some distention of the neck, and a clot of blood filled the tube and on its removal a good deal of bloody serum escaped. On January 18 (third day), the patient complained of a feeling of formication over the whole body and of a great weight which pressed on her brain. She had slept well the night before and had a normal pulse and temperature. Toward evening she complained of severe pain at the base of both lungs and next day felt dizzy and had numbness of the legs and feet. On January 20 (fifth day), in the early morning she felt fairly well but complained of numbness and tingling in the legs and face and a feeling as if ants were crawling over her skin. A few hours later she had cramps in both hands and pains in the joints and considerable stiffness of the fingers and flexion of the toes. Then there were severe paroxysms in both arms and legs. The thumbs were contracted in the palm of the hand, the fingers flexed at the metacarpophalangeal joint, the wrist flexed, and elbows bent. The toes were flexed and adducted and the feet extended. She complained of great pain in the legs, which was at times spasmodically increased; her face twitched and there was numbness and stiffness about the jaws. Chvostek's sign was well marked, and pressure on a nerve trunk produced spasms (Trousseau's sign). Pulse was 80 to 100, and she had no temperature. Her voice was very husky and she seemed stupid; she complained most of the acute pain in the legs, which at times was very severe.

As soon as I saw her I put her on drachm doses of the lactate of calcium every three hours. This was about eleven in

the morning and at 5 P.M. the spasms and cramps had disappeared; the fingers were relaxed, the voice became natural, and she said she felt very well, only tired. After five doses the lactate of calcium was discontinued as she disliked it so, and some parathyroid extract was sent for, there being none in town. On the morning of January 22, the seventh day after operation, she began to feel the sensation of formication again, with a feeling of weight in front of head and great depression. She was again put on calcium lactate drachm doses with 2½ grains of thyroid extract every four hours. She had slight cramps in her extremities that night with pain in the left side. Next day she was free from cramps but still had pressure symptoms in the head and a creepy sensation over the body. For the next two days she remained about the same and refused to take any more calcium lactate.

On the eleventh day (January 26) she was fairly well in the morning, but by noon was worse than ever, all previous symptoms being much exaggerated. The face was flushed, she was irritable, and much depressed. The parathyroid extract had now arrived and she was given 1/20 grain every four hours with three grains of thyroid extract. As she was no better next day she was persuaded to commence taking the calcium lactate again in addition to the extracts, and in consequence the improvement was rapid, the cramps disappeared, and she felt very much better. But at this time she developed a dry pleurisy on the left side which gave her much pain. On the fourteenth day she had some slight cramps, but these soon disappeared. The pleurisy was relieved by strapping. The wound had healed completely some days before.

The patient left the hospital on February 5 and was directed to take 30 grains of calcium lactate and 1/20 grain parathyroid extract every four hours. I gave the dried parathyroid, as I could not succeed in getting the fresh from the slaughter-houses. All the specimens sent me or brought by my house surgeons proved on microscopical examination to be isolated portions of thyroid tissue, so the dried preparation was continued. Twice the lactate of calcium was discontinued and the symptoms always returned, though parathyroid was still administered. She asked for the calcium lactate, for she said she always got relief within an hour after taking it. I saw her several times after she left the hospital and she told me she was never well without the

calcium lactate and whenever she omitted it the stiffness in her fingers, joints, and jaws came on, accompanied by mental depression and great irritability. I saw her on one occasion when she had not taken the calcium for 24 hours and Chvostek's sign was very marked and she complained of stiffness in her fingers and toes. She then resumed the calcium and two days later when I again saw her there was no feeling of stiffness and no Chvostek sign; she felt well and was bright and lively, going out driving for several hours each day. She always felt best when both the calcium and parathyroid were taken, and with calcium alone she was much better than with parathyroid alone. When I last saw her in March she still had some dry pleurisy on the left side.

I heard a couple of weeks ago from her home in Vermont and she was then well and able to attend to her household duties; she still continued to carry out the treatment she was pursuing while in Montreal, and she said she could not do without the calcium lactate.

This case agrees with the conclusions found by Voegtlin and MacCallum, that calcium can cure temporarily any case of tetany due to insufficiency or removal of the parathyroids. In this case, although no parathyroids were found in the removed thyroid, still there must have been some injury to these glands, due perhaps to the after-hemorrhage and distention of the cavity with blood-clot after the operation. The transplanted thyroid under the left sternomastoid muscle was tender for a few days, but afterward could be felt and was apparently functionating. What the ultimate result of this case may be I cannot tell; perhaps in time the damaged parathyroids may resume their function, for Eiselsberg and Kummer report cases of recovery after one year. If recovery does not take place after that time has expired, I should endeavor to get human parathyroids for transplantation.

June 6, 1912: I saw patient to-day. Is looking and feeling well, has gained about 20 pounds. The only symptom is oppression in head, which was corrected by lactate of calcium, of which she now takes only 20 grains twice a day.

THE SURGICAL TREATMENT OF AORTIC ANEURISM.

REPORT ON A CASE SUCCESSFULLY TREATED BY PRODUCTION OF WHITE THROMBUS.

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ANEURISM, so far as treatment is concerned, may be said to be divided into two classes, at the present time—those amenable to radical surgical treatment, and therefore curable, and those which, being inoperable in the ordinary sense, come under the care of the physician, who generally frankly recognizes that, beyond diagnosing the condition, and perhaps palliating it by rest in bed, dry diet, and the administration of potassium iodide, he can do little to cure the disease or even to arrest its progress.

To the former class belong the aneurisms of the extremities, which, in many cases, can be successfully treated by ligature and perhaps excision; to the latter class belong the aneurisms of the aorta and those of its branches close to the main trunk, where a radical excision, at least in the present state of our knowledge, is impossible. The object of this article is to draw the attention of the profession to the surgical aspects of this latter class, in the hope that many cases, at present regarded as hopeless and allowed to die practically untreated, may be given the chance of undergoing treatment which, even where it does not cure the condition as it often does, will, in suitable cases, give remarkable relief for a very considerable period.

The ordinary surgical treatment of all aneurisms is beset with difficulties more or less peculiar to the condition. In the first place, the patient's general condition is often far from satisfactory, the heart in particular being frequently markedly affected. The excitement produced by the anticipation of a

formidable operation, and the further excitement and possible struggling during the early stages of anæsthesia, throw a heavy and most undesirable load upon an already inefficient organ. Added to this, there is the extreme strain upon the heart produced suddenly at the moment of ligaturing a main vessel whose anastomoses are not developed, and death has occurred before now from this cause. In thoracic aneurism, in addition to the heart condition, the trachea and large vessels and nerves may often be affected by pressure, rendering the administration of an anæsthetic still less desirable. In the second place, it is not necessarily only the portion of artery affected by the aneurism which is diseased. It is generally recognized that it is not wise to ligature the main vessel near the aneurism, on account of its diseased condition; and, indeed, a generalized sclerotic condition of the arteries in such cases is not uncommon, a second aneurism sometimes developing, perhaps on the other side of the body.

It will, therefore, be evident that an operation for radical excision of a distal aneurism, even where perfectly possible mechanically, exposes the patient to grave risks, apart from those common to all ordinary operations.

Many operations have been devised for the treatment of aortic aneurism which have as their object the production within the sac of a red blood-clot, as it is believed that spontaneous or natural cure of aneurism occasionally occurs in this manner. Operations having this object in view, however, apart from any mechanical or manipulative difficulties which may be encountered, are always open to grave objection on the score of danger. In the first place, the rapid production of a red thrombus is always liable, even where one is dealing with a distinctly sacculated aneurism, to cause at least a partial obstruction of the lumen of the vessel, and thereby throw a severe strain upon the already weak heart, and this effect must be more pronounced where the aneurism is not markedly sacculated, and where, therefore, the clot forms chiefly or entirely in the lumen of the vessel. In the second place, red blood-clot is not a reliable substance; it is soft; does not adhere firmly to the vessel wall; is friable, and hence is very liable to be

detached as a whole or to have fragments detached from it by the vibrating torrent of blood which rushes through the aorta at each systole of the heart, and so give rise to emboli which may prove very serious, if not fatal. This danger is increased where a foreign body is introduced in the hope that the thrombus will form upon or about it, the adhesion between clot and foreign body being in many cases very slight.

With a view to obviating many of these dangers, whose reality is sufficiently established by clinical records, and at the same time of inducing the production of a strong and enduring thickening of the diseased wall of the aneurism, a method was put forward many years ago by Sir William Macewen of introducing a fine steel needle, highly polished, into the interior of the aneurismal sac or dilatation, and scratching very lightly the inner surface of the opposite wall, so as to produce a series of slight abrasions of that surface. In this operation it is not sought to produce any red thrombus, but rather, by wounding the sac wall, to set up a process of repair which, ultimately, will lead to a thickening and strengthening of the wall, if not to complete obliteration of the sac. He has found that, subsequent to this operation, a red thrombus does not form, but that a white thrombus is deposited. This white thrombus probably consists at first of a deposition of colorless fibrin, produced by the action of the leucocytes coming from the damaged wall of the vessel, acting upon the serum derived from the same source. This white thrombus is at first small in amount, seals up the damage in the vessel wall, but does not cause any marked narrowing of the lumen of the vessel. At a later stage embryonic cells, derived from the various tissues wounded by the needle, appear, and replace the fibrin, so that, in a short time, the white thrombus is replaced by granulation tissue, which, at a still later period, becomes converted into adult tissue, probably largely composed of fibrous tissue.

A remarkable point about this exudate is that, once its formation has been started, it tends, under favorable circumstances, to gradually increase in quantity, fresh fibrin being slowly deposited on the surface, to be replaced later by fibrous tissue. In some cases of aneurism of distal vessels this process

of thickening of the vessel wall has gone on gradually over a period of weeks or months, until ultimately the vessel has become completely occluded. No obliteration has been observed in the aorta, the force of the blood stream in that vessel presumably checking any attempt at undue narrowing of the normal lumen.

The advantages of this process are obvious. In the first place, there is no sudden blockage of the vessel; on the contrary, the process is essentially a very gradual one, abundance of time being given, in those cases where complete obliteration is going to take place, for the thorough development of the anastomoses, and hence strain upon the heart is obviated. In the second place, the thrombus, instead of being large and loosely adherent to the vessel wall, is at first small and is intimately associated with it, rendering detachment practically impossible; and, in the third place, the thrombus becomes progressively converted into granulation and adult tissue as it increases, so that detachment of emboli cannot occur.

Clinically, also, the process has its advantages. It is easy of application; in most cases no incision is required, and hence an anæsthetic is unnecessary, and excitement is minimized, and struggling, with consequent severe cardiac strain, eliminated, while the patient suffers but little discomfort either from the introduction of the needle or from its presence, even when it is retained for several hours. While the writer's aim is to direct attention to this form of treatment particularly for the "inoperable" forms of aneurism, it will be obvious that it possesses great advantages over ordinary operative measures for aneurism of the extremities.

Sir William Macewen has treated many aneurisms, aortic and otherwise, by this method with most gratifying results. An account of a case of aneurism of the arch which has been successfully treated by the writer by this method may be of interest.

The patient, Mrs. J., now aged 40, was placed under his care in the Elder Hospital, Govan, by Dr. Hamilton Robertson, who kindly supplied him with some notes on the case. She first be-

came ill in June, 1908, after having performed some exceptionally heavy housework, when she suffered from attacks of severe pain which radiated from the left breast to the left side of the neck and face, and down the left arm. At first the attacks of pain occurred in the early morning, but soon they became very frequent and severe, lasting, perhaps, for an hour and a half at a time. The pain was described by the patient as maddening, and it caused breathlessness and necessitated her sitting up. A holiday was taken in the hope of improving matters, but as the pain became more constant and, if possible, more severe, she came home and went to the Royal Infirmary, where she remained for a couple of months. Pulsation in the episternal notch was first noticed while she was in the Infirmary, but the pains diminished and disappeared, and she was dismissed, "much improved" by rest, medication, etc. Later, however, the pains reappeared, and when Dr. Robertson first saw her in July, 1909, she appeared to be in great distress, complaining of severe pain, pulsation in the neck, choking sensation, and cough. Respirations were rapid, pulse weak and running, and altogether she seemed so ill on the occasion of this first visit, which patient made to his surgery, that Dr. Robertson was relieved to get her safely home without her collapsing. About this time even the act of sitting up brought on an extreme feeling of collapse, dressing was accomplished with difficulty, while a walk across the kitchen floor caused extreme misery, and patient thought she was dying. The heart was found, on examination, to be enlarged; there was a loud double murmur best heard over the upper end of the sternum, and the left pulse was markedly weaker than the right.

At the end of six weeks of absolute confinement to bed, with restricted dry diet and iodides, patient was again much improved, the pain having disappeared, and the pulsation in the neck having become less marked. As Dr. Robertson considered further improvement unlikely to occur, while a return of the symptoms was practically certain unless patient was kept in bed, he recommended her transference to the Elder Hospital. She was conveyed to the hospital in October, 1909, in an ambulance, and carried to bed in a stretcher. She remained in the hospital for seven weeks, during which period a needle was twice introduced and a large area of the posterior wall was treated. She expressed herself as feeling better after the treatment, but it was thought wise to let her return, as she had come, in an ambulance. She returned

to the hospital in January, 1910, had a needle introduced once, remained in hospital for a month, and was able to go home in a cab. She now felt so much better that she was able to walk a little, and she went to Rothesay for a holiday, and was able to go about and enjoy herself. She returned to the hospital in October, 1910, remaining there for a month, and on this visit had two needles introduced simultaneously on two occasions, at an interval of a fortnight. Thereafter patient began to feel very much better. The choking sensation had quite gone, and she was able to go about freely without any sensation of faintness or collapse, nor did the pains reappear at any time.

Now, in July, 1912, patient expresses herself as having been given a new lease of life, and as feeling better than she has done for many years back. Not only can she go about freely; she can go up and down stairs actively without assistance or inconvenience; she can perform ordinary light household duties; there is no pain nor choking sensation, and she further states that she has entirely recovered from severe headaches which had caused her much suffering prior to the appearance of the aneurism. Pulsation is still noted in the neck, as is to be expected, owing to the deep or posterior wall being the one which was treated, but it is not marked, and only becomes noticeable when patient is excited. Whereas, in the early stages of the disease, the left pulse was markedly weaker than the right, it is now at least as strong. Thus this patient, who, prior to surgical interference, thought she was dying, and was admittedly very ill, has gradually improved under treatment until now, 16 months after the last needling, she feels better than she has done for many years past.

In conclusion, the writer would urge the desirability of early diagnosis and treatment. When an aneurism has become enormous, and, for example, has produced a large perforation in the sternum, the mere excitement produced by the idea of having something done may easily predispose to leakage or even rupture, and thus even the simple procedure of needling may of necessity be abandoned. Thoracic aneurism in particular is admittedly difficult of diagnosis in some early cases, and the great assistance given by an examination by X-rays should then be borne in mind.

PRIMARY SARCOMA OF THE PERITONEUM.*

REPORT OF A CASE.

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PRIMARY sarcoma of the peritoneum is extremely rare. The retroperitoneal type is more frequently met, while primary sarcoma of the mesentery and omentum, though sufficiently rare to be worthy of citation, is the most common form of this type of malignancy.

The symptomatology varies within wide limits, dependent on the location and mechanical effects produced on neighboring organs. However, the classical signs, such as malaise, rapid loss of weight, and cachexia, are constant accompanying factors. Gastric symptoms, as nausea and vomiting, are frequently present, as are also the other signs of digestive disturbance, as intestinal cramps and persistent diarrhœas. The abdominal pains that present are not to be associated with the growth of the tumor. This new growth is very rapid in development, and is easily palpable and freely movable, which is a distinguishing feature between this form and the retroperitoneal type. Mobility does not, however, serve as a point of differentiation between this and other intraperitoneal forms, such as mesenteric or omental sarcomata. This can only be cleared up at operation or post mortem.

The prognosis is exceedingly grave, as recurrence or metastasis is the rule, even though there be few adhesions or attachments to adjacent structures, or having its only attachment at the site of origin. The retroperitoneal type presents an even more grave prognosis, as it is usually inoperable from its incipiency and tends to early softening and disintegration.

An examination of the literature of intra- and retroperi-

* Read before the North Texas Medical Society, June 18, 1912.

toneal sarcoma of primary peritoneal origin, covering 61 reports and citations of cases, shows that among them there is only one, that of Dr. J. M. Elder, published in the ANNALS OF SURGERY in 1908, on the subject of primary sarcoma of the peritoneum of the intraperitoneal variety, such as the following case, which was referred to me October 11, 1911, by Dr. F. H. Sanvignet, of Laredo, Mexico, to whom I am much indebted.

Mr. M. G., Mexican, age thirty-seven, married. Family history good as to parentage and offspring. Past history negative as to present illness, patient having had no illness save diseases of childhood. Was a ranchman and lived an active, out-door life. Normal weight, 168 pounds; present weight, 134 pounds. Present illness began four months ago, when patient was kicked by a horse in the right side of the abdomen just within the anterior superior iliac spine. From this time patient has suffered pain and tenderness in this locality, but not, however, till about six weeks ago, or two and a half months after the injury, did he suffer any digestive disturbances. This presented as an intermittent diarrhœa accompanied by anorexia and nausea and abdominal pains, from which time he dates the beginning of his loss of weight. This continued for two or three weeks, when patient himself discovered a mass in his right iliac region, which is described as then feeling about the size and shape of a lemon. Was movable and not tender. During the succeeding 24 days it has attained the size of two cantaloupes placed end to end.

He has lost 34 pounds; complains of a dull ache in his right side and sense of weight. Anorexia is pronounced accompanied by seizures of nausea but no vomiting. Frequent stools,—6 to 10 or 14 daily,—watery in character, some mucus and occasional traces of blood. Feet or ankles have not swollen; no urinary disturbance. Genito-urinary history negative. No headaches; no ocular or visual disturbances.

Physical Examination.—Appearance depleted; complexion sallow, facies placid though drawn; muscles flabby. Examination of head, neck, chest, extremities, and lymphatics negative. Blood-vessels soft; blood-pressure, systolic, 96, diastolic, 78. Pulse regular, 93; temperature, rectal, 99.8°; respiration 22.

Abdominal examination reveals a large mass in the right iliac region, extending from Poupart's ligament below to the lower border of the ribs above, and from the iliac spine and flank to the mid-line. The mass was freely movable, seeming to be fixed only at a single point to the inner side of the iliac spine. Manipulation induced neither pain nor muscle spasm. There was a sense of fluctuation perceived on percussion.

Urinalysis negative. Blood examination showed hæmoglobin 62 per cent.; red blood cells, 3,600,000; white blood cells, 7200; differential: polymorphonuclears 72 per cent.; small lymphocytes 22 per cent.; large lymphocytes 4 per cent.; eosinophiles 2 per cent. Wasserman negative; Widal negative.

October 14, 1911, under gas anæsthesia, the abdomen was opened, exposing a neoplasm springing by a large pedicle, soft and vascular, from the peritoneum just over the brim of the pelvis, about two fingers' breadth to the outer side of the sacro-iliac synchondrosis. There were no other intestinal or mesenteric or omental attachments or adhesions. Removal of the growth including the base of the pedicle was easy, after which further examination revealed no evidences of metastasis.

The post-operative course was uneventful. The digestive disturbances disappeared, the diarrhœa ceased spontaneously, and the patient's appetite was rapidly regained. He was discharged on the eighteenth day.

The pathologist's report was "spindle-cell sarcoma." The gross appearances of the tumor were typical of sarcoma.

The end results, however, have borne out the gravity of the prognosis in these cases. In about three weeks after returning home, the patient suffered a recurrence of the diarrhœa from which he had suffered prior to operation, accompanied progressively by anorexia, severe abdominal pains, and seizures of extreme nausea, which continued till the time of his death, January 26, 1912, a little over three months after his operation.

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THROMBOSIS OF THE MESENTERIC VESSELS.

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DISEASE of the vessels of the mesentery as a cause of abdominal symptoms has been looked upon as such a rare condition that but little attention has been given it. During the past year the reports of several operators have called attention to this condition and apparently prove that it is not as rare as supposed. Thrombosis of the mesenteric vessels may result from injury or be secondary to other foci of infection in the intestinal canal, or may be metastatic from distant foci of infection.

Sprengel states that disorders of the mesenteric vessels may appear either as bloody infarcts of the bowel wall or as anæmic gangrene—the former as a result of the obliteration of an arterial or venous vessel, and the latter when with the blocking of a certain arterial region the retrograde blood stream is also closed. The results vary according to the area of blood supply affected, and may produce small areas of necrosis of the intestinal wall with resulting ulcers or else sphacelus of many inches of intestine.

Symptoms.—The initial symptoms are always acute and severe, but there are no pathognomonic signs. Pain is excruciating, and may be accompanied by vomiting and in some cases by discharge of blood from the bowel. The symptoms resemble closely those of intestinal obstruction by band, but may easily be mistaken for an acute inflammatory condition, as an appendicitis or a perforated intestinal ulcer.

Diagnosis is exceedingly difficult and only rarely has been made before operation or post-mortem examination. Obstruction of the bowels is usually not complete, and the occurrence of bloody discharge might lead one to consider the case one of intussusception.

The cases may be divided into the acute, subacute, and

chronic. In the acute cases a large area of intestine is affected at once, with severe shock and death within a few hours. These cases, as in Case I here cited, are universally fatal.

CASE I.—*Splenectomy followed by thrombosis of the superior mesenteric vein* (ANNALS OF SURGERY, vol. xxi, 24).

Three weeks after the removal of the spleen for simple hypertrophy, the patient was suddenly seized with severe abdominal pain, vomiting, and collapse. In a few hours the temperature reached 104°. The prostration was so great that operation was not attempted. The symptoms all pointed to intestinal obstruction. Death came 22 hours after the onset and autopsy showed gangrene of nearly two-thirds of the small intestine due to thrombosis of the superior mesenteric vein.

In doing resection in these cases we have no distinct line of demarcation, as in cases of gangrene of the gut due to constriction, and great care must be taken to divide the intestine well outside of the affected area in tissue with a good blood supply. If this is not done, union will fail at the point of anastomosis and leakage with fatal peritonitis follow.

The cases we designate as subacute give more chance for treatment and recently several successful cases have been reported (report N. Y. Surgical Society, ANNALS OF SURGERY, March, 1912). The case reported by Dr. N. W. Green is a good example of this variety.

One week before coming under observation this patient ate some food which was followed by diarrhœa and cramps for two days, and three days later she passed a black stool. The acute symptoms began three days after this, when at 3 A.M. she was awakened with severe abdominal pain one inch to the left of the umbilicus. The pain gradually increased in severity but remained localized in the mid-abdomen with tenderness in that region. The taking of medication was followed by nausea and vomiting. A diagnosis of intestinal obstruction was made and operation undertaken 16 hours after the acute onset. When the peritoneum was incised a litre of red fluid escaped. A coil of intestine, reddish-black in color, was found extending transversely and slightly upward from the left iliac fossa to above the ileocæcal region. The mesentery was red and œdematous. Over five and a half feet of gut was resected and anastomosis with Murphy button completed. This patient made a complete recovery. The pathological examination showed thrombosis of the mesenteric veins.

The chronic cases are the result of the occlusion of the smaller vessels near the bowel with resulting areas of necrosis followed by ulceration, inflammation, and contraction. These cases after the acute onset may go on for several months with more or less severe abdominal symptoms before coming to operation. Cases II, III, and IV here reported are considered by us as belonging to this class.

CASE II.—Male, aged fifty-six, liberal user of alcoholics for years. This man had arisen from his seat in a trolley car when suddenly the car was brought to a stop. This threw him violently against the side of the seat, the full blow being received on the abdomen in the neighborhood of the umbilicus. He suffered considerable pain, but in a few minutes was able to get home, some three blocks away, without assistance. During the entire night and the following two days he suffered severe abdominal pain, and on the second day had a dark tarry movement, showing the escape of blood in the intestine. This continued for several days. The patient soon got about and was quite well for nearly two years, except for some irritability of the bowels. Two years later after playing several games of tennis he was seized with a severe pain in the right side of the abdomen. He went home and to bed, the symptoms then centring about the liver. There was rise of temperature, severe pain, and marked tenderness over the right lobe of the liver. A diagnosis of abscess of the liver was made and operation advised. During the night a severe hemorrhage from the bowels occurred and so reduced the patient that operation was postponed. The hemorrhages from the bowel continued and caused the death of the patient five days later.

Postmortem revealed an abscess in the lower portion of the right lobe of the liver, a perinephritic abscess, and in the intestine innumerable small ulcers, most of them showing fresh blood on the surface. The mesentery was much thickened and the veins in part occluded.

It would seem that the injury in this case had caused a thrombosis, and as a result ulceration of the intestine with secondary abscess of the liver.

The primary bleeding was likely due to the thrombosis and

congestion. The severe bleeding was due to the ulceration which developed at the points of necrosis in the mucous membrane.

CASE III.—*Intestinal obstruction due to ulcerations and contraction in the small intestine probably due to thrombosis.*

E. D., male, aged 24, seen first June 12, 1911. Eight months before the present trouble he was perfectly well except for a small hernia. One night about 11 o'clock he was seized with severe pain about the hernia, but was unable to relieve himself in any way, as he was on the street. The pain continued to increase and the tumor could be felt to enlarge. He arrived home about an hour later completely exhausted. About 3 A.M. of the next morning he was operated on. At this time the scrotum, as described by the operator, was nearly as large as a child's head. After opening the sac the gut was seen to be deeply congested but not gangrenous, and as it showed decided improvement when the constriction was relieved, the mass of intestines, about two and a half feet, was returned. He made an uninterrupted recovery. As soon as he began to get about, he suffered with abdominal pains and distress and difficulty in moving the bowels. This continued to grow worse and interfered with his nutrition.

Condition on Examination.—Patient had been an athlete, now he is a mere skeleton with little flesh left. The abdomen was tense although not greatly distended, and through the thinned abdominal wall could be seen the peristalsis of the intestine, which always stopped at a point near the umbilicus and was accompanied by much pain.

Cramps sometimes were repeated every few minutes and at other times at intervals of several hours. The pain bore no relation to the taking of food. Vomiting was occasional, never contained blood, and was independent of taking food.

June 9, 1911, temperature 99.2°; pulse 95; blood: whites 12,000; polymorphonuclears 77 per cent.

Operation (June 12, 1911).—Median incision. The upper small intestine was distended to at least twice the normal size of the colon. This ended abruptly at about the beginning of the ileum and for about two feet the gut was narrowed, bound down to the posterior abdominal wall, and irregularly thickened, some

areas appearing almost gangrenous. The mesentery was much thickened and contained numerous hard nodules. This length of intestine was resected and the ends of both proximal and distal portions closed. A lateral anastomosis was then performed, the great distention of the proximal portion forbidding any other procedure. Abdomen closed without drainage. Recovery absolutely uneventful, primary union of the wound, and discharge of the patient on July 1.

Four months later he reported in perfect health, having gained 60 pounds, and looks and feels, he says, as he did before the first operation.

Pathological Report by Dr. Blatteis.—Length of intestine 58 cm. Circumference of dilated proximal portion four times the normal and length 30 cm.

At the end of the dilatation is an area of fissured mucosa covered by a false membrane.

All coats of dilated portion are atrophied. From the end of the dilated portion, extending a distance of 16 cm., is a marked constriction of the gut. The narrowest point of the constricted portion is at the beginning, where the lumen is not more than the diameter of a lead-pencil, and varies slightly throughout the constricted portion. All walls are markedly thickened, and along the mesentery of this portion are many palpable glands, varying in size from a small pea to a bean.

The mucosa presents many ulcerations, varying in degree from multiple fissures to deep ulcers extending to the peritoneal coat.

The entire mucosa is covered by a false membrane. At the point of greatest constriction, the wall is thickened to a degree suggestive of tumor formation.

The remainder of the gut is œdematous, showing occasional fissures and granulating areas.

Histological Report.—Sections of thickest portion at point of greatest constriction show simple hypertrophy involving the muscular and serous coats; the mucosa is completely ulcerated, all coats showing numerous collections of round cells and dilated lymph spaces.

Sections of other portions show the same process only to a less degree. Lymph-nodes show simple inflammatory hyperplasia.

Comments.—The first point of interest in this case is the sudden slipping of a bubonocele below the truss and its rapid descent into the scrotum and the size it attained. The primary operation was well and successfully performed. The second point and most important is, What was the cause of the development of the pathologic conditions found at the

second operation? It is our belief that a thrombosis of some of the mesenteric vessels occurred, resulting in ulcerations at many points in the intestine, followed by healing and contraction of the resulting scars, thus diminishing the calibre of the intestine. Some of the ulcers did not heal and were still active, keeping up the inflammatory process and infecting the mesenteric glands.

The constriction of the mesentery by the neck of the sac or possibly the necessary handling in reducing the large mass was the cause of the thrombosis. This would suggest such an accident as a possibility in any abdominal operation where the mesentery is handled and some of our cases of post-operative intestinal paresis may be due to this cause.

CASE IV.—*Intestinal obstruction due to intestinal ulceration with perforation and adhesions.*

Mrs. K., aged 24, married. Nothing in the early history bearing on the present trouble. Two years ago was operated by median incision, she says, for pelvic abscess. Following this was never entirely well. Five months before being seen by us was operated for abdominal abscess. This wound, situated just to the right of the first, was a long time in healing because of the development of a fecal fistula. A third scar exists to the left. Just what these early operations were we are unable to learn. Present trouble began three days before the case came under our care with severe abdominal cramps, and persistent vomiting, which became fecal 48 hours later.

Enemata were without result. Temperature 99.3°, pulse 105 but very poor in quality. Abdomen was slightly distended, markedly tender all over, but without any muscular rigidity.

Operation (October 18, 1911).—Median incision. The thinned-out omentum was spread out over the congested coils of intestine. There was no distention of the bowels. The small intestine was collapsed over about eight feet and on inspecting this we found six separate points of constriction of the jejunum and ileum. At each of these points, when the adhesions were released, was found a small round perforation of the intestinal wall. These points were all separated and the perforations closed in by suture. The abdomen was flushed and then closed without

drainage. The patient reacted well from the operation. Two days later the wound was found inflamed and the superficial sutures removed. This was followed by the discharge of foul smelling pus having a fecal odor due to colon bacillus infection. Considerable sloughing followed and for six weeks there was a profuse pus discharge. This gradually subsided, and at the end of ten weeks the patient left the hospital well.

The point of interest in this case is the presence of six separate points of ulceration in the small intestine. These had perforated and by the adhesions produced had angulated the bowels to obstruction at as many points. There were thickened areas at several points which probably represented other ulcers. What the original condition was we do not know; the ovaries were evidently not removed, but I believe the secondary ulcerations were due to either a secondary thrombosis or embolism of some of the terminal mesenteric vessels with ultimate necrosis and ulceration of the intestinal wall.

The cause in these two cases seems to be similar, viz., interference with the blood supply, in the first thrombosis due to pressure and in the second thrombosis or embolus due to sepsis. The second and third operations in Case IV were evidently done for abscess due to intestinal perforation, for in each instance a fecal fistula persisted for some months.

MALIGNANT TUMORS OF THE MESENTERY

WITH REPORT OF A CASE.

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THE literature on this subject is quite limited, in fact the usual books of reference have but little if anything to say about these growths. The paper by Jas. Vance in the March, 1906, number of the ANNALS OF SURGERY is the most exhaustive study of this subject thus far made.

Vance reviewed the literature for five years previous to the date of his report, and found 28 cases of solid tumor of the mesentery. Of these cases 9 were fibromata with 8 recoveries and 1 death; 7 sarcomata with 1 recovery and 6 deaths; 2 lipomata with 2 recoveries; 2 myxofibromata with 2 recoveries; 1 carcinoma with 1 death; 1 lymphangioma with 1 recovery; 1 tubercular with 1 death; 1 colesteoma with 1 recovery; 1 hæmatoma with 1 death; 1 myxoma with 1 death, and 1 large spindle-celled tumor with 1 recovery, making a total of 27 cases, 16 recoveries and 11 deaths, one case not being reported.

A further analysis of these cases shows that out of 27 operations there were 13 resections of bowel, varying in length from one inch in the shortest to 98 inches in the longest. Of these 13 resections, six died and seven lived, making a mortality of about 46 per cent. Three of these were for sarcoma, all of which died. The number of males affected is 11, ranging in age from fourteen to seventy years, against 16 females, ranging in age from eight to sixty years.

In 1897 Harris and Herzog collected reports for 57 cases of solid tumors of the mesentery, which are classified as follows: 16 cases of carcinomata, 10 cases lipomata, 1 case lipoma with calcareous masses, 3 cases of myxolipomata, 1 case of fibrolipoma, 2 cases of fibromata,

1 case of fibroma with calcareous degeneration, 1 case of fibromyxoma, 1 case of osseous tumor, 2 cases of fibrocartilaginous tumors, 1 case of chylangioma, one case of adenolymphoma, 1 case of malignant lymphoma, 7 cases sarcomata, 1 case of fibrosarcoma, 1 case of lymphosarcoma with colloid degeneration, and 7 cases with no data, or indefinite, making a total of 57 cases.

In this classification most of the cases reported as carcinoma, probably, without any question, belong to the sarcomatous type. Death was invariably the outcome in all these cases, the final result being as follows: 46 cases died, 10 recovered following an operation, and in 7 cases no data were given. In those 10 cases which recovered three were malignant in type.

Diagnosis of mesenteric tumors is very difficult, as the subjective symptoms are in no way distinctive; pain, constipation, nausea, and vomiting are usually present. The signs that most clearly give evidence of mesenteric tumors are their position, their mobility, and their relation to other organs. Free mobility is the most important diagnostic sign, as no other abdominal tumor will show this to such a marked extent. Of course if the tumor gets to be of sufficient size, this mobility is much diminished on account of the growth filling up the abdominal cavity.

If it can be determined that the tumor is separated from the solid viscera, then the diagnosis is comparatively easy. The only possible treatment for these tumors is surgical. Early recognition and prompt removal will undoubtedly reduce the present mortality, which is much too high.

My principal reason for presenting this subject at this time is the following case, which I wish to report:

Mrs. C. was referred to me by Dr. Conmey of Sergeant Bluff, on account of an abdominal tumor. The patient was fifty-seven years of age and well nourished. She had only noticed the growth about four months previous to her consultation with Dr. Conmey, but from the time that she first noticed it, it had

grown very rapidly. The growth was wedged down tight in the pelvis, as if connected with the uterus. Upon section, which was done at the St. Joseph's Hospital, April 4 of this year, it was found that the growth was not uterine in origin but was mesenteric. The growth was removed and with it sixteen inches of ileum, and a side-to-side anastomosis was made. The patient made an uneventful recovery. This growth one month after removal weighed 67 ounces.

The following reports are from Dr. Meis, of Sioux City, Ia., and Dr. B. M. Edlavitch, of Iowa City, who both examined sections from this growth. Dr. Meis reports as follows:

"The examination of specimens from the tumor which you sent me is as follows: Microscopic examination of section from the growth reveals it to be a fibrosarcoma. The fibrous tissue is very dense and firm and through the entire tumor are scattered areas of small round cells.

"As a general rule such tumors are of a very low degree of malignancy, but there may be exceptions."

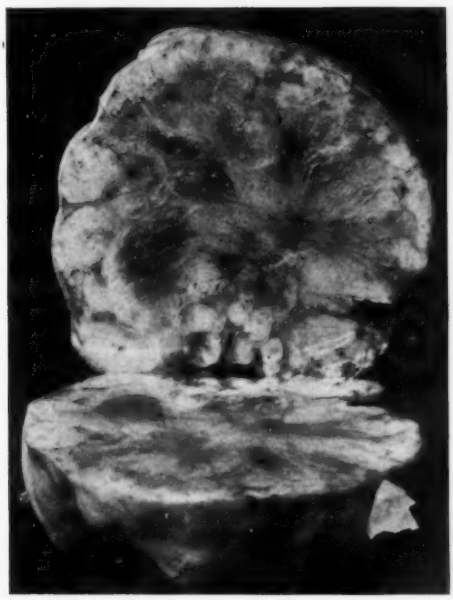
Dr. B. M. Edlavitch, pathologist at the University Hospital at Iowa City, examined the specimen and reports as follows:

"Microscopic examination shows that the growth is essentially fibroid in nature, but scattered throughout the tissue are found numbers of small and large areas made up of small round cells, indicating that the tumor is of the type known as fibrosarcoma. Such tumors are of a relatively low grade of malignancy."

FIG. 1.

Fibrosarcoma of mesentery after removal. Note the loop of ileum involved and removed with the tumor.

FIG. 2.



The tumor, shown in Fig. 1, after section.

VOLVULUS OF THE STOMACH.

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VOLVULUS of the stomach is a complete rotation of the organ through a vertical or horizontal axis. It is usually found as a complication of some pathological condition outside the stomach as: (1) hernia of the diaphragm; (2) inflammation in the region of the stomach; (3) tumors of the stomach wall; (4) ptosis of the neighboring organs. There have been reported quite a large number of cases of this character, although it is a rare condition.

Five cases of volvulus of one sac of an hour-glass stomach (usually the cardiac), and three cases of volvulus around a vertical axis have also been reported. But apart from these where there is an evident pathological condition as a causative factor, there have occurred a small group of cases of volvulus of the stomach where nothing pathological either of the stomach itself or in its neighborhood can be found. To this group Payer gives the name idiopathic volvulus. During the past winter such a case came under my care at Freedman's Hospital, the history of which is as follows:

AUTHOR'S CASE.—Joseph W., aged forty, male, colored, single. Admitted to Freedman's Hospital December 7, 1911, at 1 A.M., complaining of severe pain in the epigastrium, which had come on suddenly after a heavy evening meal. He gave a history of frequent attacks of pain and indigestion after eating, and of two previous attacks resembling the present. One occurred about two months ago, and the second one month ago. On both occasions about one hour after eating the largest meal of the day the patient was seized with sudden cramps in his stomach. Induced vomiting and deep, prolonged massage in the stomach region finally brought relief. These attacks lasted about

twelve hours, but the patient did not recover sufficiently to return to work for several days. The patient admits excessive, constant gin drinking, and is said by his friends to be a tremendous eater, gulping his food without mastication.

On admission to the dispensary apomorphine was given by hypodermic, without result, and an attempt was made to wash out the stomach; this was unsuccessful, although the house surgeon thinks he was able to pass the tube into the stomach. The patient was not relieved, and was sent to the ward. He slept a little at intervals that night. He was able to swallow two ounces of salts at 3.45 A.M., and then eructated a large amount of gas. The pain increased in severity, and at 8 A.M. he was again given apomorphine without result.

When seen at 10 A.M., patient was found sitting up in bed grasping his knees with his forearms. His suffering seemed more that of fear and oppression than acute pain. His expression was anxious and he asked if he could be saved. Respirations were rapid, catchy, and labored. Pulse was small in volume, and irregular in force, some beats hardly reaching the wrist.

On examination there was noticed a most remarkable distention of the upper abdomen, reaching from the ensiform cartilage to the umbilicus, and everting the costal arches; this tense swelling extended to the mammillary line on the right. On palpation the limits of this mass extended slightly beyond those noted on inspection; it felt hard and very tense. The abdomen below the umbilicus was not distended, but the muscles showed some rigidity. On percussion this distended area was highly tympanitic. Heart action was rapid, weak, and irregular; a beat was quite frequently dropped. The apex beat was heard in the fourth interspace above the nipple; sounds weak but clear.

All attempts to pass the stomach tube being futile, the patient was sent to the operating room. Under cocaine anæsthesia an incision about two inches long was made in the mid-line three inches below the ensiform cartilage. The tense stomach was exposed *not* covered with omentum, and was punctured with a large trocar. Gas under great pressure escaped with a whistling sound, and the distention began to subside. A catheter was then introduced in place of the trocar and a great quantity of gas and 54 ounces of brown grumous fluid were evacuated. Incision, in what was thought to be the anterior wall of an acutely dilated

stomach, was sutured with silk and the abdominal wound closed. The abdomen had then resumed its normal contour, and the heart had moved back to its usual place.

The patient's condition, however, did not improve; his pulse keeping rapid and irregular. Salt solution with adrenalin was given under the skin, and the patient returned to the ward. At 8 P.M. his temperature was 96.2° and his pulse 132. He was given 400 c.c. of normal salt solution under each breast, and an attempt made to wash out his stomach. Death occurred at 12.55, fourteen hours after onset. A partial autopsy was allowed, and I quote from Dr. Van Swearingen's report:

"Body of well-nourished man, about 178 cm. long, weighing about 85 kilos. Pupils slightly dilated. Ears and nose normal. Teeth in good condition. Chest resonant. Abdomen markedly distended from ensiform to umbilicus. Tympanitic on percussion. Recent operative wound in epigastrium about 4 cm. long, 5 cm. below ensiform. No glandular enlargement. No other surface markings. Genitals and extremities normal.

"On opening abdomen there is a fair amount of subcutaneous fat. The intestines are moist and glistening, free from exudate or adhesions. The stomach is found completely inverted and markedly dilated, so that the posterior wall becomes anterior, and the greater curvature is pressing against the diaphragm. In the posterior stomach wall half way between the greater and lesser curvatures is a small operative wound. The gastrocolic omentum is torn free from the greater curvature of the stomach, and the transverse colon is found lying below the stomach. On opening the stomach a large quantity of gas escaped, and the contents are found to be bloody and grumous. On washing the mucous membrane nothing pathological is found, except dilatation of the vessels. The heart is dilated, and walls thinner than normal. All the valves are normal. No other organs examined."

After a careful review of the literature, I find eight cases reported of true idiopathic volvulus. They all occurred in the foreign literature, and none in English. We will confine our attention entirely to this group.

All the reported cases come under the classification isoperistaltic, of Payer, that is the volvulus was in the direc-

tion of normal peristalsis, to the front. Three cases of the antiperistaltic variety have been reported by Neumann, Delangre, and Berg; but they were all cases of volvulus in hour-glass stomachs.

In the idiopathic volvulus the stomach turns from left to right and from back forward around the lesser curvature. The line passing from the cardia to the pylorus is the axis of rotation. The greater curvature rotates through an arc of 180° and the organ is turned completely upside down. The greater curvature comes to lie above, under the left lobe of the liver and the left diaphragm, while the lesser curvature is below. The anterior wall looks backward, and the posterior wall is found looking forward under the anterior abdominal wall. On opening the abdomen, it presents itself in the wound covered by the great omentum; unless through rupture of the gastrocolic omentum it is bare as in my case. The lesser and greater curvatures having lost their relative positions are recognized by their vessels. None of the reported cases showed any degree of strangulation, *i.e.*, the vessels were not compressed by the twisting. The openings of the stomach are the fixed points around which the rotation occurs, and are therefore twisted. When this rotation reaches 180° their lumina are occluded. Experiments and clinical observations show that obliteration is first produced at the pylorus, and as a consequence adds to the distention of the stomach already present. This may reach extreme proportions. In the case cited by Dujon, the stomach filled the abdomen, hiding the small intestine and touching both the liver and the pubes. The neighboring organs may be displaced by this distention, especially the pancreas, the spleen, and the colon. Wiesinger's case showed fat necrosis, from occlusion of the duct of Wirsung, caused by the displacement of the pancreas. Borchardt had to do a splenectomy on his case as a result of hemorrhage due to tearing of the splenic vessels.

The colon is usually above the inverted stomach, accompanying the greater curvature. In this position the distention of the stomach obstructs the transverse colon, and we find,

as in Neumann's case, enormous dilatation of the ascending colon passing upward and to the left. The left portion of the transverse and the descending colon are found lying empty like a ribbon across the left side of the distended stomach. The two viscera increase reciprocally their dilatation, and oppose reciprocally any attempt at reduction. It is the common experience of the operators that the stomach, at least, must be emptied before reduction is possible.

Attention was first drawn to the possibility of a volvulus occurring in the stomach by Berti in 1866. In his case, the condition complicated a case of tumor of the stomach wall. Mazotti and others reported further cases, which were reviewed by Leube in 1878. All the cases then cited were of extrinsic origin, and most of them found in cases of hernia of the diaphragm. Leube speaks of them as of no clinical significance but only of pathological and anatomical interest. But since the reporting of the so-called idiopathic variety, the subject has assumed an important clinical value, because of the rich opportunity for radical surgical cure when diagnosticated early.

Apart from the rarity of the condition, the chief interest lies in its etiology, and all writers give this phase a good deal of consideration. A study of the motility of the stomach will help us in this regard.

The teachings of the older text-books of anatomy and physiology of the stomach have been greatly revised in the past few years. It has been proved by the X-ray that the stomach alters its position and shape to a surprising degree during the process of digestion. It can be truly said that there is no fixed normal position for the stomach. Glenard first showed that the usual position was nearly vertical, and that with advancing years variations from this became more and more frequent. Rôntgenologists have proved that the entire stomach, except the pyloric portion, is normally found on the left, and that the lesser curvature is toward the midline and almost parallel to the vertebral column. The large curvature curves from the upper left diaphragmatic dome

downward and to the right. The pylorus is often found at a higher level than the greater curvature. In children the stomach is usually of a horse-shoe shape with the greater curvature at a lower level than the pylorus. Simmons considers volvulus more liable in children on account of this relative gastroptosis which simulates the pathological conditions found in the reported cases in the adult. Two of the eight recorded cases were in children.

It has been demonstrated, by Reidel and others, by the X-ray that the filled stomach rotates toward the front. Landois has confirmed this observation, and has pointed out how an exaggeration of this rotation produces anterior volvulus. That it occurs so rarely is because of the limiting ligaments which anchor the stomach more or less to the neighboring organs and diaphragm. Dujon was only able to produce artificial volvulus in the cadaver after dividing the gastrosplenic ligament and the great omentum. Neumann also insists on the laxity or rupture of the stomach attachments as one of the most important etiological factors. This lengthening of the ligaments with its consequent prolapse permits the development of sufficient space under the diaphragm to admit the inverted stomach of volvulus. These conditions are found in cases of gastroptosis, and many of the writers reporting cases of volvulus suggest gastroptosis as an etiological factor in its production.

Wiesinger and Dujon suggest in addition a congenital lengthening, stretching, or rupture of the gastrocolic omentum as a contributing cause. Borchard from his case is of the opinion that trauma may play a causative rôle. On the other hand, Pendl considers a short, thickened, gastrocolic omentum necessary to produce volvulus. He is of the opinion that abnormally strong peristalsis of the transverse colon by dragging the greater curvature of the stomach upward toward the left diaphragmatic dome produced the volvulus in his case. Neumann agrees with the view that gastroptosis is of primary importance, but attributes the rotation to increased abdominal pressure forcing the distended colon upward and dragging the greater curvature of the stomach with it.

In reviewing the reported cases it is seen that there is but one factor common to all: relaxation or rupture of the stomach ligaments. It is my opinion that the underlying cause must be found in the stomach itself.

We know the stomach is most firmly fixed to the posterior abdominal wall at the cardia and pylorus. During distention it moves and rotates, in the direction of least resistance, *i.e.*, to the front and upward. If there is a ptosis of the organ and the distention becomes marked, then this rotation may continue till a total volvulus results. As gastroptosis has been shown in recent years to be a relatively common condition, it is evident that this distention must be extreme to produce a volvulus. In my opinion an acute dilatation in such a stomach will produce idiopathic volvulus, or in a stomach when the ligaments give way under the strain and are ruptured. In the cases of Wiesinger and myself rupture of the gastrocolic omentum occurred after a very full meal, in individuals where there was no evidence of gastroptosis. Borchard's case was caused by a trauma, which very often precipitates acute dilatation. So that we must look to the etiology of acute dilatation of the stomach to explain the causation of volvulus. Of this we are still uncertain, although the suggestion, I believe, of Dr. Robert T. Morris of New York, that it is due to "lack of splanchnic control" appeals to me as the most likely explanation of all cases. We know that the division or paralysis of the splanchnic nerves in a dog will cause acute dilatation of the stomach. There is usually a history of profound shock to the splanchnics, traumatic, operative, or from the central nervous system in cases of acute dilatation in man. This explanation does not apply of course to cases of gastromesenteric ileus, or where the mesenteric vessels are proved to have obstructed the duodenum.

When the acute dilatation occurs in a stomach whose ligaments are relaxed, the normal rotation forward and upward is not limited. The rotation continues till the pylorus becomes twisted and finally occluded. At this stage the pa-

tient may vomit, or the stomach tube may be passed. It is spoken of by Payer as partial volvulus. It has never been seen *per se*, but probably always precedes true or total volvulus. The further rotation of the stomach on a nearly horizontal axis to 180 degrees next occludes the cardia by twisting, and we have the characteristic clinical picture presented.

The usual history is of sudden onset of pain and distention. Vomiting may occur, or the stomach tube may be passed early in the case. The vomiting then ceases although the distention remains and increases. Inability to take food or medicine then ensues from closure of the cardia. The stomach tube now does not pass. The patient suffers a characteristic oppression with pain in the upper left abdomen and thorax. The heart is found displaced upward and toward the left. The upper abdomen is greatly distended, with eversion of the costal arches, and the lower abdomen is comparatively flat. The condition must be differentiated from simple acute dilatation; from acute pancreatitis; from gastromesenteric ileus, perforative peritonitis and intestinal obstruction. A careful physical examination with the use of the stomach tube should make the diagnosis clear.

The treatment is entirely surgical. In a case presenting the usual picture of acute dilatation of the stomach, and when the stomach tube cannot be made to pass the cardiac orifice, laparotomy should be immediately performed. The stomach should be emptied by aspiration and then replaced in its normal position. Gastropexy is indicated if the patient's condition permits.

The following is a summary of the cases reported:

CASE I.—BERG, in 1895, reported a case of a man of forty-one, who for several years suffered from nervousness, especially after exertion, and also from insomnia. On November 12, though not having his usual appetite, he ate an unusually large meal at noon, during which he eructated gas, and immediately after he felt severe pain in the abdomen. He continued his meal and the pain increased in severity; at this time he became nauseated. He went to his office, where he vomited three or four times. At 3 P.M. he came home and vomited food for the last time. Nausea ceased, but the pain continued. At 7 P.M.

the patient complained of a severe pain and the nausea returned; temperature 37.7° C., pulse 80. The abdomen was not distended, but on percussion gave a tympanitic sound. The region along the outer border of the left side of the thorax for about 2 cm. downward was somewhat hard and sensitive. The vomited matter had a rancid odor, and was composed of discolored meat and a little fluid. A weak solution of soda given the patient was at once rejected. On the following day at 2 P.M. the left hypochondrium and mesogastric region were found distended, and the inferior half of the left thorax was projecting and felt like a tumor. It was sensitive to the slightest pressure, and extended by its inferior convex border to the median line 7 cm. above the umbilicus and on the right to the region of liver dulness and to the parasternal line. The pain varied with the position of the patient, but the distention remained permanent. An œsophageal sound was introduced to a depth of 47 cm. from the dental arch, where it met absolute resistance. At 6 P.M. an abdominal incision 8 cm. long was made in the median line. The anterior surface of the tumor was covered with omentum. An exploratory sound was introduced into the tumor, but little gas escaped, and after some manipulation clear liquid of rancid odor escaped in gushes. The sound was replaced by a trocar. The smaller the tumor became, the higher rose the point of puncture together with the trocar toward the left side; so much so that after having evacuated 1 litre of the fluid it was feared that the incision and trocar would disappear in the abdominal cavity to the left of the incision. The tumor was still too much distended to allow an examination. An oblique incision was now made along the left border of the thorax, where it was noticed that the omentum which covered the tumor increased in thickness from above downward, which confirmed the diagnosis of torsion of the stomach. An incision was then made into the tumor, and two more litres of fluid which became more and more turbid, and was mixed with food débris, escaped. The tension entirely disappeared; the wound in the stomach was closed. There were no adhesions, no constrictions, no peritoneal changes. The walls of the stomach were thin but otherwise normal. After having replaced the stomach the small curvature appeared to lie deeper than in the normal state. The further course was uneventful. There was no fever, no vomiting. Food was retained. The wound healed by first intention. Patient left the hospital twelve days after operation, and was able to take up his vocation one week later.

Berg in discussing his case raises the question whether or not every case of spontaneous rupture of the stomach, in which no ulceration can be found as a cause, is not caused by volvulus. He points out the impossibility of a diagnosis of volvulus being made after rupture has occurred.

CASE II.—WIESINGER, in 1901, reported the case of a man aged forty-one, who was taken sick suddenly with symptoms resembling intestinal obstruction. The characteristic symptoms were vomiting, constipation, pain, and distention of the abdomen. The pain was marked

in the left side of the abdomen, and principally in the left hypochondrium, Wiesinger, who saw the case three days after onset, found a tumor in the left side of the abdomen. On opening the abdominal cavity a considerable quantity of serosanguineous fluid containing fibrinous clots was found. The peritoneum was very much congested. All the upper part of the left side of the abdomen, from the left hypochondrium to the mid-line and downward to the umbilicus, was occupied by a tumor the size of a man's head, greatly distended, immovable, and entirely covered by omentum. The omentum was soft, œdematous, and fixed by recent numerous adhesions difficult to break up. It contained many spots of fatty necrosis, which in the course of the operation were found in many other places, and principally in the neighborhood of the pancreas. The diagnosis of fatty necrosis was confirmed by microscopic examination. After pushing aside the omentum, he recognized that the anterior surface of the tumor was nothing else than the anterior surface of the stomach. In order to diminish the tension a trocar was introduced, and a litre of brownish flocculent fluid was syphoned out. This contained lactic acid but no trace of hydrochloric acid. The distended stomach was pressing the transverse colon under the liver and the empty coils of small intestine against the pubes. After careful examination of the viscera it was found that the anterior surface of the tumor was the *posterior* surface of the stomach; that the organ was twisted around its transverse axis 180 degrees. The small omentum served as a pivot. The pylorus was situated above and in front; the cardia was hidden behind, a little to the left; both were kinked, compressed, and occluded on account of the torsion and enormous dilatation of the stomach. The large curvature was free throughout its length except at the pyloric end, the gastrosplenic ligament and the great omentum being completely torn off. The stomach was opened, and about three litres of sanguineous fluid mixed with food débris escaped. It was then only possible to replace the organs in their proper positions. No foreign body was found; the orifices and mucous membrane were intact.

CASE III.—DUJON, in 1901, reported the case of a boy aged five. He had all the symptoms of occlusion of the intestines, vomiting after partaking of food, extreme distention of the abdomen, no flatus. An exploratory incision was at once undertaken. On opening the peritoneum a quantity of serous fluid escaped. An enormous organ distended like a balloon appeared to occupy the whole of the abdominal cavity. The case being complicated and the child too weak to stand a prolonged operation, it was decided to close the abdomen. The patient died the following morning. At the autopsy it was found that the stomach, distended to an extraordinary degree, filled up the whole of the abdomen and was found twisted around its axis 180 degrees.

CASE IV.—BORCHARD reported a case of a man forty-four years old, who had received a severe blow on the epigastrium two days before; this was followed immediately by sharp pain. He had vomited only once. When seen on the second day distention of the epigastrium and left hypochondrium was found, with pronounced eversion of the left rib

border. The sides of the abdomen were flat; the patient was in slight collapse. A systolic murmur was found at the apex of the heart, which was markedly displaced. The stomach tube was negative. Laparotomy disclosed the stomach, reddish-blue in color and distended, high up under the dome of the left diaphragm. Hemorrhage of the splenic vessels led to splenectomy. The stomach was immovable, and after aspiration it collapsed without resuming its normal relations. Death from hemorrhage followed. At autopsy volvulus of the stomach was found. The organ was rotated through 180 degrees on a nearly horizontal axis, with the occlusion of both the cardia and pylorus. The transverse colon was found under the stomach with extreme stretching of the gastrocolic omentum. An aneurism of the aorta was also found.

Borchard distinguishes the supra- from the infra-colic volvulus, and lays emphasis on singultus as a symptom and trauma as a contributing cause.

Case V.—Pendl, in 1904, reported the case of a man aged sixty-three. He had had a severe attack of abdominal pain from flatulency, and had recovered. Then he was seized again with severe pain and symptoms which led to operation. An abdominal incision disclosed a cystic tumor covered with omentum. The right portion of the transverse colon (not distended) passed in an upward and backward direction to the left, to be lost under the liver and behind the tumor in the left diaphragmatic dome. To the left the collapsed descending colon lay like a band across the left side of the tumor, passing from behind forward and downward. The omentum and mesocolon lay over the tumor; these were torn and the tumor identified as the stomach. It was punctured with a trocar and replaced by dragging on the transverse colon. The great curvature was rotated upward and backward 270 degrees. The point of puncture which had been closed lay (after reposition) on the posterior wall upward and backward to the left. The stomach was very large, the lesser omentum greatly lengthened, as was the entire transverse mesocolon. The gastrocolic ligament was thickened and shortened by the deposition of smooth fibrous tissue.

Case VI.—Sinjuschin's case was in a man fifty-five years old, whose history was negative. He was seized at night with sudden pain in the epigastrium; this was followed by nausea and vomiting. Later the nausea continued, but he was unable to vomit. In the morning his condition was grave. There was severe collapse with small thready pulse and cold extremities. The epigastrium was greatly swollen, tender, and highly tympanitic. With the idea of a possible volvulus of the stomach he was operated upon under a local anæsthetic. A large cystic tumor covered with omentum presented, and was made out to be the stomach rotated forward through 180 degrees. The transverse colon was above the stomach. Only after being emptied by incision could the stomach be replaced. Collapse and death followed operation twenty hours after onset. At autopsy round ulcers near the cardia in the lesser curvature and evidences of gastroptosis were found.

Case VII.—Peyer reports the case of a man of fifty-nine, who had always had good health. He had suffered for many years from attacks

of stomach cramps, which came on after the mid-day meal at great intervals. If he doubled up with his arms across his stomach and practised steady pressure, the attack would not be accompanied by vomiting, and would pass away in a short time. Last attack fourteen days before. Present attack set in one and one-half hours after the mid-day meal, while the patient was carrying a roll of tin, weighing fifty kilos, up a ladder. He slipped and struck himself in the epigastrium with the tin. He immediately felt violent pressure and pain in the region of his stomach. He recognized the pain from previous attacks, but it was so violent that it led to severe collapse. He was able to take liquids at this time without vomiting. One hour after onset he came to observation and was taken to the hospital.

He was a powerfully built man of medium height with abundant subcutaneous fat. He was in slight collapse; his heart showed the following exceptional symptoms: The apex beat was only faintly palpable in the left midaxillary line. The sounds were plainly though faintly heard at the same place. The tricuspid sounds were heard under the sternum; they were clear as were the bicuspids. The lungs were negative. As Peyer had known the man previously to have had a normally placed heart, he was struck with the exceptional displacement. The abdomen was comparatively flat, only the epigastrium being somewhat swollen. Pain was increased by pressure in this region. The patient was profoundly oppressed from, as Peyer thinks, the sinistrocardia. Otherwise the examination was negative. In the next hour the taking of liquids became more and more difficult, till regurgitation ensued. The stomach tube could not be passed into the stomach. The X-ray showed extreme sinistrocardia, with marked displacement upward of the left diaphragm. Repeated enemata were moderately successful. A tentative diagnosis of stomach volvulus was made on account of the (*a*) sudden onset, (*b*) distention in the epigastrium, (*c*) sinistrocardia, (*d*) gradual loss of swallowing, and (*e*) the thoracic oppression. After all therapeutic measures had failed and seven hours after onset, laparotomy was performed. The region of the stomach was hidden by a voluminous fat omentum, which after raising disclosed the transverse colon high up under the diaphragm throughout its entire course. The stomach was rotated forward and upward, dragging the colon with it. There was a volvulus of 180 degrees with closure of the pylorus and cardia. With great difficulty the great omentum and greater curvature of the stomach were pulled down. Reposition took place with a snap. There were no adhesions. When the orifices became free audible and palpable gurgling into the intestines was noticed. The corrected stomach showed unusual gastroptosis, and was quite large. Both the pylorus and cardia appeared pressed close together. The pylorus was sunken and the small curvature unusually deep, with elongation of the lesser omentum. Palpation of the diaphragm was negative. The great omentum was voluminous, but short and contracted. The abdomen was sutured in layers. After operation the heart lay in its normal position. The sounds were plainly heard at their proper places. On recovery from the anæsthetic all pain had ceased. Death followed in twenty-four hours from heart

failure. Autopsy showed fatty degeneration of the heart as the cause of death. The abdomen showed the same changes noted at operation.

CASE VIII.—M. L. KRIMHOLTZ, in April, 1911, reported the case of a girl three and one-half years old, who had a complete anterior volvulus of the stomach; she recovered.

She had dysentery at the age of one year and eight months, otherwise her history was negative. On April 29, 1909, after taking a cup of chocolate, she was seized with violent pains in the epigastrium. After taking water containing valerine, she vomited several times. There was no distention. She was relieved of her pain by midnight, but at 7 A.M. after taking castor oil, the pain recurred and vomiting ensued. She vomited all that day. An enema brought a good bowel movement. That night severe nausea, but without vomiting, came on and acute distention became apparent. She was seen April 30, at 3 P.M., and the first diagnosis was ileus. The stomach tube was introduced with great difficulty, but without result. The pain increased in severity and the distention became more marked. Operation April 1. The stomach was found cyanotic and greatly distended and rotated forward on its axis 180 degrees. The transverse colon was not dislocated, and the volvulus was easily reduced, but without decreasing the distention. Therefore, gentle massage was tried, but there occurred regurgitation of stomach contents into the œsophagus, causing asphyxiation. Artificial respiration was begun with clearing of the fauces and they succeeded in saving the little patient. Her recovery was complicated by a pneumonia. Her wound healed *per primam*. She entirely recovered, but has what is apparently a normal diarrhœa. A subsequent attack of whooping-cough had no effect on her stomach or intestines.

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TUMORS OF THE AMPULLA OF VATER.

WITH A REPORT OF TWO CASES.

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CASE I.—A man, aged sixty-three, was sent to me by Dr. Galt of Cottingham, in May, 1910, on account of progressive jaundice and wasting. For about 30 years he had been subject to periodical bilious attacks, vomiting, and headache, though until the present illness he had never been jaundiced.

The present illness began six months before with gradually increasing jaundice. He had no pain or sickness. Four months before I saw him he went to Buxton but was unable to undergo a proper course of treatment owing to the cold weather. While there he thought the jaundice lessened slightly. After that the jaundice altered little and at the time of his visit to me he thought he was no more deeply tinged than he had been five months previously.

His fæces were pale, bulky, and soft, and the urine dark. He had lost about two stone in weight since the jaundice commenced. Apart from the jaundice and loss of weight, he complained of no other symptoms, though he found that fats did not agree with him.

On examination he was seen to be a thin, markedly jaundiced man. The liver was enlarged, and the gall-bladder was palpable as an oval tumor reaching nearly to the level of the umbilicus. There was no abdominal tenderness.

The urine and fæces had been examined by Dr. P. J. Cammidge in February, 1910. The following is his report:

"Urine: Reaction acid. Specific gravity 1016. Traces of albumin. No sugar, acetone, or aceto-acetic acid. Indican, well-marked reaction. Bile, well-marked reaction. Urobilin, traces. Urea 1.62 per cent. Chlorides and phosphates, normal. Pancreatic reaction "C," a few fine crystals soluble in 5 to 10 seconds.

"Fæces: White, soft, solid. Reaction, acid. Stercobilin, fairly well-marked reaction. Occult blood, *nil*. Microscopically

a few fat globules, many fatty crystals, a little vegetable tissue. Organic matter 82 per cent. of the dry weight. Total fat, 42.9 per cent. Unsaponified fat, 18.7 per cent. Saponified fat, 24.2 per cent. Organic matter not fat, 39.1 per cent. Inorganic ash, 18 per cent. Gross's insufficiency test, casein digestion very incomplete in 30 hours.

"The presence of bile pigment shows that there is some obstruction to the free flow of bile into the intestine, but the fairly well-marked reaction for stercobilin in the fæces shows that the blocking of the common duct is by no means complete, as it usually is in malignant disease of the head of the pancreas. The presence of traces of urobilin, although generally met with when gall-stones are present in the common duct, is uncommon in cancer of the pancreas unless there are secondary growths in the liver. The results of the pancreatic reaction in the urine point to there being some active degenerative changes of an inflammatory nature in the pancreas, and although these may be due to the irritation of the gland by a growth and the changes consequent upon blocking of the pancreatic duct by a growth as occurs in about 25 per cent. of cases of cancer of the pancreas, such changes are much more commonly due to gall-stones in the common duct.

"The well-marked reaction for indican points to there being abnormal putrefactive changes in the contents of the upper part of the intestine with catarrh of the walls, and in my experience this is rarely associated with cancer of the pancreas. Although the urine contains traces of albumin the normal critical solution point is against there being any serious interference with the function of the kidneys.

"The fæces do not contain the marked excess of unabsorbed fat usually seen in malignant disease of the pancreas, nor is there the excess of unsaponified fat generally encountered in such cases. The latter may, however, be due to the abnormal activity of fat-splitting organisms in the intestine, which the excess of indican in the urine and the high percentage of inorganic ash, pointing to a catarrh of the intestinal walls, suggest are probably present.

"It is probable that the color of the stools is due in part to the activity of anaërobic organisms, for it contains a fair amount of stercobilin, and the quantity of fat is not alone enough to account for the appearances. The results of Gross's insufficiency

test point to there being some serious interference with the functions of the pancreas, and suggests either malignant disease or marked cirrhosis of the gland. The absence of any occult blood is a point rather against cancer of the pancreas unless in a very early stage."

On the whole the report seemed rather in favor of chronic pancreatitis than malignant disease, and this concurred with the clinical diagnosis.

Exploratory operation was advised and accepted. In view of the intense jaundice and the possible diminished coagulative power of the blood, 20 c.c. of normal horse serum were injected subcutaneously 24 hours before the operation.

Operation (May 11, 1910).—The gall-bladder was greatly distended and free from adhesions. It was emptied by means of a trocar; no stones were felt. On palpation the common duct was felt to be dilated, and the lower part of the head of the pancreas was considerably enlarged and firm. It felt fairly smooth and was not of a stony hardness.

The duodenum was mobilized by incising the peritoneum to its outer side. On palpating the posterior surface of the duodenum a hard, irregular nodule was felt in the situation of the papilla. It was about the size of a hazel-nut and felt more like growth than calculus. In order to make certain of its nature the duodenum was incised transversely across its anterior wall, and the nodule pushed forward into the opening; it was then seen as a pale papillomatous projection about half an inch in diameter. Clamps were applied to the duodenum and gall-bladder and cholecystduodenostomy performed, utilizing the openings already made.

The patient made an uneventful recovery and left the nursing home on the twenty-sixth day, complexion, stools, and urine normal in appearance.

I next saw the man a year later. His doctor reported that he had continued in very good health until two months previously, when he began to suffer from epigastric fulness and discomfort after food with occasional bile-stained vomiting.

At the time of my visit he was greatly emaciated. The stomach was visibly contracting, the greater curvature reaching below the umbilicus. No tumor could be felt in the abdomen. The stools were of normal color and presented no gross evidence of blood.

The urine and stools were again examined by Dr. Cammidge, who furnished the following report:

"Urine, acid; 1031. Albumin, traces. Sugar, bile, acetone, *nil.* Indican, well-marked. Urobilin, traces. Pancreatic reaction, negative.

"Fæces, greenish-yellow, soft, solid, strongly alkaline. Stercobilin, well-marked. Occult blood, *nil.* Pancreatic insufficiency test, casein digestion incomplete. Total fat, 59.1 per cent. of dry weight. Unsaponified fat, 19 per cent. Saponified fat, 40.1 per cent.

"The well-marked reaction for indican in this specimen of urine points to there being abnormal putrefactive changes in the contents of the upper part of the intestine with catarrh of the walls. The absence of bile pigment shows that there is no obstruction to the free flow of bile into the intestine, but the traces of urobilin point to there being some interference with the functions of the liver and suggests some cholangitis. This is probably due to an ascending infection from the duodenum. The negative result of the pancreatic reaction is against there being any active degeneration of an inflammatory nature in the pancreas at the present time, but does not exclude malignant disease or cirrhosis of the gland. The absence of bile pigment is, however, against there being cancer of the head of the pancreas.*

"The specimen of fæces contains about 16 per cent. more unabsorbed fat than that last examined, but the proportion of unsaponified fat is practically the same, suggesting that the increase is not due to more advanced disease of the pancreas. The results of the pancreatic insufficiency test are also much the same, and while they point to there being some interference with the functions of the pancreas, are not such as are usually met with in malignant disease, corresponding more to those obtained in cirrhosis of the gland. The absence of any trace of occult blood shows that there is no bleeding, ulcerated surface in the course of the gastro-intestinal tract at the present time and is against the diagnosis of malignant disease of the stomach, intestine, or pancreas. A single negative reaction does not, however, exclude simple ulcer. The strongly marked alkaline reaction of the stool and the marked excess of saponified fat tend to confirm the diagnosis of chronic intestinal catarrh, and suggest that the large intestine as well as the small is involved. It is therefore probable that the high proportion of total fat is to be at-

* This does not take into account the cystenterostomy.

tributed largely to disease of the intestine interfering with absorption."

The clinical symptoms were those of partial duodenal obstruction below the anastomosis between the gall-bladder and intestine. It seemed unlikely that this obstruction was caused by enlargement of the tumor, for in that event the surface of the growth would probably have become ulcerated, and occult blood would have been demonstrated in the stools.

Second Operation (April 30, 1911).—Stomach dilated, thick-walled, contracting. Pylorus and seat of former operation hidden by adhesions. A firm lump about the size of a walnut could be felt in the situation of the duodenum. No secondary nodules in liver. I thought it wise not to disturb adhesions, so performed posterior gastro-enterostomy in the usual manner. On the eleventh day the upper part of the wound broke open, allowing a portion of colon to protrude. This was replaced and the wound resutured. The patient seemed none the worse for this, further progress was uneventful, and he went home on the twenty-seventh day eating well without pain or discomfort.

I again saw the patient in consultation on September 30, 1911. Since the last operation the bowels had always been loose, acting two or three times a day, an evacuation being generally brought on immediately by eating. He described the stools as being light colored, semisolid, and of a peculiar odor. He had recently been getting thinner in spite of the fact that his appetite was excellent and that he was eating very well. He was able to lead an active life. Abdomen showed no alteration.

A third sample of fæces was examined by Dr. Cammidge.

"Appearance, white, soft, solid. Reaction, strongly acid. Stercobilin, well-marked. Occult blood, *nil*. Pancreatic insufficiency test, casein digestion very incomplete. Organic matter, 92 per cent. of the dry weight. Total fat, 54.1 per cent. Unsaponified fat, 41.2 per cent. Saponified fat, 12.9 per cent. Organic matter not fat, 38.8 per cent. Inorganic ash, 7.1 per cent. Microscopically, crowds of fat globules and fatty acid crystals and many undigested muscle fibres.

"This specimen of fæces contains a slightly lower percentage of total unabsorbed fat than that last examined, but there is a very marked increase in the proportion of unsaponified fat relative to the saponified form, suggesting that the digestive functions of the pancreas are being much less satisfactorily per-

formed. This is confirmed by the results of the pancreatic insufficiency test and the presence of a large number of completely undigested muscle fibres microscopically. The strongly acid reaction of the stool is also in favor of there being serious pancreatic disease. The absence of any occult blood shows that there is no bleeding, ulcerated surface in the course of the gastro-intestinal tract at the present time, and is against a diagnosis of malignant disease of the stomach, intestine, or pancreas. It is therefore probable that the pancreatic insufficiency is due to advanced cirrhosis of the pancreas or to blocking of the duct. The well-marked reaction for stercobilin shows that there is no serious obstruction to the free flow of bile into the intestine at the present time."

It was evident that the man was suffering from pancreatic insufficiency. He gradually became weaker and died in January, 1912.

CASE II.—A man, aged sixty-five, was brought to me by Dr. Evans of this city with a history of a feeling of lassitude of about four months' duration.

He often felt chilly and inclined to sit over the fire. During one of these attacks three weeks previously he was first noticed to be jaundiced. This had since increased, but he thought it was variable. During this illness he had lost six pounds in weight. He had no pain nor vomiting, though he felt sickly.

Some years ago he had indigestion with colicky pains in the epigastrium; latterly he had suffered from flatulence.

On examination he appeared to be slightly jaundiced and was thin looking about the face. The abdomen was rather full and the liver enlarged, reaching down to the level of the umbilicus, with a prominence in the situation of the gall-bladder.

A fortnight later the jaundice had increased and his weight had diminished by three pounds. The temperature chart showed a daily variation between the morning and evening records with an occasional rise of 2° F.

Diagnosis.—Common duct stone; pancreatitis.

He entered the nursing home and was given an injection of horse serum (20 c.c.) the day before operation.

Operation (May 3, 1912).—Liver enlarged with distended bile capillaries on its surface. Gall-bladder greatly distended and thin-walled. Calculi felt in cystic duct. Gall-bladder punctured with trocar, giving exit to thin, turbid mucus. The open-

ing was enlarged and six facetted pigmentary calculi removed from the dilated cystic duct. No bile followed their removal, only a quantity of mucopurulent fluid. Careful examination failed to reveal any more stones in cystic duct.

Nothing was felt in supraduodenal part of common duct, but at the lower end of the common duct in the posterior wall of the duodenum was felt an oval mass the size of a large olive. This was movable, but could not be pushed up above the duodenum; it had a clearly defined outline and was of firm consistency, but did not feel as hard as a stone.

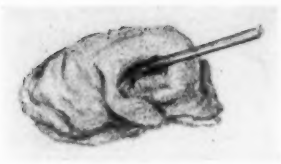
The duodenum was mobilized and its anterior wall incised transversely over the mass, which was then readily projected through the anterior incision. It appeared as an oval projection with its long axis coinciding with that of the duodenum and covered with the mucous membrane of the posterior wall. On its most prominent part was the stretched opening of the ampulla. It was readily lifted away from the tissues posteriorly. A small cut was made into the mass, exposing a pale, bile-stained tumor substance.

The mucous membrane was incised around the tumor, which was then drawn forward and cut away. A quantity of turbid mucus escaped from the divided end of the common duct. A small, oval, unfacetted stone was removed from the upper end of the common duct. The cut edges of the dilated bile-duct were sutured to the margins of the mucous membrane. The cut end of the pancreatic duct could not be identified in the wound, so the lower part of the incision was not sutured. The anterior incision in the duodenum was closed by suture. Further palpation of the common duct showed a palpable lymph-node a little way above the duodenum and a firm mass of several nodes in the gastrohepatic omentum just to the left of the hepaticocystic confluence. The gall-bladder was drained and the abdomen closed.

During the first few days bile was freely discharged from the gall-bladder; thereafter the discharge consisted of slightly bile-stained turbid mucus. The common duct was washed through every few days with saline.

On the eleventh day, in the hope of acting on the enlarged nodes felt at the operation, I inserted 5 mg. of radium (1,800,000 activity) mounted in a silver sheath 1 mm. thick on the end of a

FIG. 1.

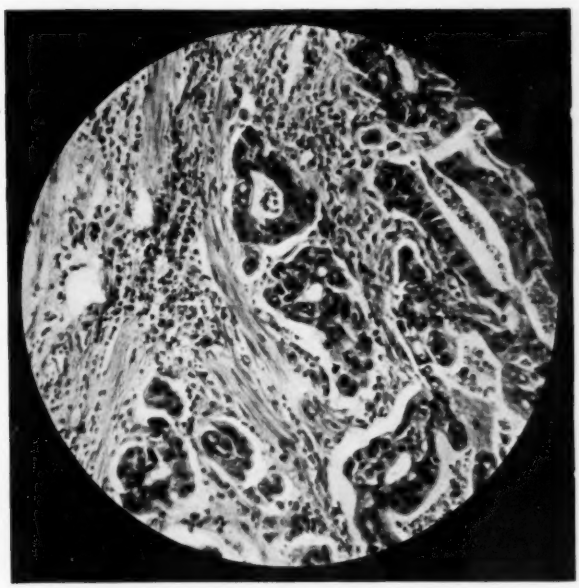


Carcinoma of ampulla of Vater, duodenal aspect.

FIG. 2.

Carcinoma of ampulla of Vater, posterior aspect, showing dilated bile and pancreatic ducts.

FIG. 3.



Carcinoma of ampulla of Vater, × 120 diameters.

probe into the cystic duct for a depth of 5½ inches. This was left in place for six hours and repeated on the following day for four hours.

He went home on the twentieth day. He felt well, the jaundice was fading, there was still a slight discharge from the sinus.

One month later his doctor reported that the sinus was healed, there was no jaundice, and he was gaining weight at the rate of two pounds a week.

Pathological Report.—The specimen removed is an oval mass covered on one aspect by duodenal mucous membrane, and measures 3 x 2 cm. The mucous membrane appears normal and is movable over the tumor. On the summit of its anterior aspect is the enlarged opening of the ampulla; there is no protrusion of growth through it.

At one point an incision has been made through the mucosa, exposing a pale friable tumor stained a pale greenish-yellow with bile.

The posterior aspect of the specimen shows the dilated sections of the common and pancreatic ducts. The pale papillomatous surface of the growth protrudes backward into both these openings.

Cross section of the specimen shows the ampulla filled and distended by the tumor, which appears to be springing from its walls and shows a tendency to extend upward along the ducts entering the ampulla (Figs. 1 and 2).

Microscopical examination shows the tumor to be a columnar celled adenocarcinoma (Fig. 3).

There is probably no position within the body, outside the central nervous system, where a growth, while yet so small, is heralded by more wide-spread symptoms than at the lower end of the common bile-duct.

The most profound jaundice and its attendant misery of itching, together with grave interference in the functions of digestion, due to the blocking of the bile and pancreatic ducts, may be caused by growth no bigger than a pea.

Most often the growth is a columnar celled adenocarcinoma, though a benign polyp of the duodenal papilla has been described by Krause.

The tumor is of slow growth and remains small for some time, being commonly described as the size of a hazel-nut or the tip of the little finger.

Viewed from within the duodenum its projecting surface is papillomatous and paler in color than the surrounding mucous membrane. At other times the growth does not protrude into the duodenum but is evident merely as a rounded prominence surmounted by the gaping orifice of the ampulla. It shows little inclination to penetrate the wall of the duodenum or common duct, nor has it much tendency to break down. Occasionally it is more flat and infiltrating in type, or forms a ragged ulcer with overhanging edges.

Extension of the local growth may occur upward along the mucosa of the common duct. Metastases are not very common. Schüller [2] found them in 15 per cent. of his cases, generally in the liver. He suggests that the primary tumor most often causes death before the development of secondary nodules. Lymphatic invasion occurs in the glands along the common duct.

Hotz [3] divides localized carcinoma of the ampulla into four groups:

1. Periampullary carcinoma; which springs from the intestinal mucosa, closes around the openings of the ducts, and extends around the duodenum.

2. Tumors growing from the common duct. Small polypoid carcinomata, at most the size of a walnut, of papillomatous structure. They block the ampulla and prolapse into the intestinal lumen.

3. Small annular ulcerated growths in the lower part of the common duct. They lead to infiltration of the surrounding tissue, to compression of the bile-ducts, and show, contrary to the polypoid form, a great tendency to regionary extension, especially in the pancreas. They also form distinct metastases.

4. Growths derived from portions of pancreas displaced in the walls of the ampulla.

When it is remembered that the diameter of the lower

portion of the common duct lies between three and four millimetres, and that the orifice of the ampulla is even less, it becomes evident how little is needed to produce obstruction. It should be borne in mind that it is not necessary for the lumen to be filled to cause obstruction; in one of Morian's [1] cases the lumen was not encroached upon, but a kinking of the duct led to stasis of bile.

The obstruction, however produced, leads to a dilatation of the common duct which may reach the size of the thumb, and to an increase in its length. This affects the intramural portion of the common duct and has an important bearing on operative treatment.

If the cystic duct is not obstructed and the gall-bladder not shrivelled from previous cholecystitis, this latter organ will be greatly distended with bile or mucus and its walls thinned. This distention of the gall-bladder may lead to secondary ulceration of its wall, and in certainly three cases it has ruptured.[2]

The pressure of the bile leads also to dilatation of the hepatic ducts and even affects the bile capillaries within the liver, which sometimes form cysts on its surface.

The liver becomes enlarged and shows a condition of biliary cirrhosis; this, however, is not often marked enough to cause portal obstruction; consequently the spleen is not usually enlarged and still more rarely is there true ascites. When ascites is present it is more likely to be due to the enlargement of lymph-nodes in the portal fissure.

As in other prolonged cholæmic states, there is tendency to subcutaneous and intestinal hemorrhages and, what is more important, a likelihood of continued bleeding after any operation.

The presence of bile salts in the blood may lead to albuminuria; their absence from the intestine results in constipation and inefficient fat absorption. The obstruction is not always absolute, so that stercobilin may be found in the fæces.

An ascending cholangitis from infection of the dammed-up bile is far from uncommon.

These are all the direct effects of biliary obstruction and

are common to other affections blocking the main bile-duct. Growths of the ampulla also lead to closure of the pancreatic duct, and the effects of this remain to be considered.

In the first place the ducts within the pancreas are not always dilated. It is reasonable to assume that the pressure within them is not less than that in the bile-ducts, but that the substance of the gland affords them more support.

The obstruction of the ampulla is apt to lead to a chronic interlobular pancreatitis which is rarely associated with glycosuria. The interference with pancreatic function is largely responsible for the wasting seen in these cases, and it may be the cause of death after the biliary stasis is relieved by operation.

While a growth of the ampulla will implicate the duct of Wirsung, it must not be forgotten that the duct of Santorini may open separately into the duodenum, draining the upper part of the head of the pancreas; it may carry its secretion into the duct of Wirsung, or again it may form a connecting channel between the main pancreatic duct and the duodenum above the papilla. It may be that in this last event it acts as a safety-valve and by relieving the main duct of pressure prevents its dilatation.

In my first case the enlargement of the head of the pancreas was definitely limited to the lower part; this, I think, may be explained by assuming that the secretion from the lobules forming the upper part of the head had a separate outlet by the duct of Santorini.

An interesting question arises as to the relation of growth in this situation to gall-stones. In contrast to cancer of the gall-bladder it is only in the minority of cases that calculi are found in association with cancer of the ampulla. It is also a striking fact that cancer of the ampulla occurs more often in men than in women,* contrary to the proportion of the sexes affected with gall-stones.

The most striking features in the clinical picture of this disease are its painlessness, the intensity of the jaundice, and the great emaciation.

* Though among the cases treated by radical operation more than half are women.

The diagnosis of obstructive jaundice is obvious; but it is less easy to distinguish ampullary cancer from the other causes of biliary obstruction.

Stone in the common duct is hardly likely to be confused with an uncomplicated case of cancer of the ampulla. It is true that in the latter condition the jaundice may fluctuate, but the painless enlargement of the gall-bladder and the afebrile course of the disease are sufficient to distinguish it from calculous obstruction. If the case is complicated with cholangitis, the distended gall-bladder is the only hint that the obstruction is due to neoplasm. Finally it must be remembered that (as in Case II) the two affections may co-exist.

Chronic pancreatitis is in most cases preceded by symptoms of cholelithiasis; apart from this and the greater frequency with which it is accompanied with epigastric pain and tenderness, there is little to help in the diagnosis. Indeed, carcinoma of the ampulla is probably always associated with a certain degree of chronic pancreatitis. The most that one can say is that the pancreatitis is probably not dependent upon malignant disease if the patient has suffered for a year or more.

In primary cancer of the head of the pancreas there is more likely to be a period of ill health preceding the onset of the jaundice.

Chronic duodenal ulcer with involvement of the papilla in the scar would be recognized by the characteristic history. Primary cancer of the duodenum secondarily implicating the papilla may be, but is not always, suggested by the symptoms of pyloric obstruction preceding the jaundice and by the early appearance of occult blood. Primary cancer of the common duct above the ampulla (and the most frequent site is the hepaticocystic confluence) is marked by a more unvarying jaundice and a lesser distention of the gall-bladder. One would also expect to find less interference with pancreatic function.

Unfortunately examination of the fæces is not of much aid in diagnosis, for the commoner causes of biliary obstruction—gall-stones, cancer, and chronic inflammation of the pan-

creas—are equally liable to be associated with pancreatic insufficiency.

It is probable that an exact diagnosis will rarely be made, but I think in the presence of increasing jaundice, wasting, and a distended gall-bladder, exploratory operation should be advised unless the surgeon feels confident that the disease is primary cancer of the pancreas, a condition in which even palliative operations have a terrible mortality.

A consideration of the cases of carcinoma of the ampulla treated surgically shows that a large proportion of the mortality is due to post-operative hemorrhage. In the present state of our knowledge this may be best controlled by the preliminary injection of serum. In the two cases here reported I used normal horse serum, and this is my usual practice before operating on cholæmic patients. Deaver [4] recommends fresh human serum, preferably obtained from a relative of the patient.

Operation in these cases will be generally undertaken as an exploratory measure; an operative diagnosis is, therefore, the first thing to be attained.

The gall-bladder should be aspirated and the bile passages palpated for stone, particular attention being paid to the lower end of the common duct. If there is any suspicion of hardness or thickening here, the posterior peritoneum should be incised vertically to the right of the duodenum and this part of the intestine stripped up together with the lower end of the common duct and head of the pancreas. These viscera can now be brought forward into the wound and accurately palpated. If the tumor can be pushed up into the supraduodenal part of the common duct, it is of course a calculus. A considerable range of vertical mobility in the thickness of the posterior wall of the duodenum is, however, possessed by ampullary tumors of the non-infiltrating type; in fact they may be remarkably elusive to the grasp.

The next step is incision of the anterior wall of the descending portion of the duodenum. A transverse incision is the best, as it occasions less bleeding and affords ample room for inspection of the papilla and for any operative procedures

that may be necessary, whether the mass is a growth or stone.

Having determined the existence of a growth of the ampulla, it remains to decide whether treatment is to be palliative or radical.

The slow evolution of the growths leads one to expect a fairly long period of relief from palliative measures. One of Morian's cases[1] lived 15 months after cholecystenterostomy, and in my first case death did not occur until 20 months after operation.

In the case of Lejonne and Milanoff a carcinoma of the ampulla was found at autopsy two years after cholecystenterostomy had been performed.*

It must be remembered that a profoundly icteric patient is not in a condition to bear a severe operation, and it may be thought wise to meet the most pressing indication—jaundice—and leave a radical operation until a later date.

The palliative measures available are cholecystostomy, cholecystenterostomy, or choledocho-enterostomy.

External drainage of the gall-bladder is to be avoided if possible as a palliative operation. In most cases the simplest method is to perform cholecystduodenostomy, uniting the openings already made in the gall-bladder and duodenum. There is no difficulty in bringing the enlarged gall-bladder and mobilized duodenum into contact without tension.

If the operation is done merely with the object of relieving the jaundice, it will be wiser to perform cholecystjejunostomy (by the transmesocolic route) and defer opening the duodenum until a more favorable occasion.

Choledochoduodenostomy, also external drainage of the common duct, must be reserved for those cases where the gall-bladder cannot be utilized. Transduodenal choledochotomy above the ampulla is open to the objection that extension of the growth would probably involve the anastomosis.

The more radical treatment of excision may be carried out in two ways:

If, after opening the duodenum, the tumor is found to be

* Quénu (Rev. de Chir., 1909, xxxix, 466) questions whether the operation was performed for this condition.

small and localized, it may be drawn forward with forceps, the mucous membrane divided around it, then by further traction the common duct and pancreatic duct are drawn out of their connective-tissue sheaths and divided. This may be done without fear of detaching the common duct from the duodenum, for, as Navarro [5] points out, the distention of the common duct leads to a lengthening of that part of it which is bound to the posterior wall of the duodenum.

The dilated common duct is readily sutured in the upper angle of the defect in the posterior wall of the duodenum. The end of the duct of Wirsung is not so readily found, and it seems of little moment whether it be sutured to the duodenal mucosa or not. It would probably be wise to complete the operation by draining the gall-bladder.

The other method consists of a circular resection of the duodenum followed either by axial anastomosis or by closure of the cut ends and gastro-enterostomy. The passage of bile may be provided for by implantation of the common duct into the bowel or by cystenterostomy. The duct of Wirsung may also be isolated and implanted into the intestine, or the lower cut end of the duodenum may be sutured over the raw surface of the pancreas.

This operation has been worked out by Desjardins [6] and Cotte,[7] and carried to a successful issue by Kausch.[8]

I believe that the simpler operation of transduodenal excision will prove the best for most cases of cancer of the ampulla. If the growth is too extensive to be removed in this way, a palliative operation will be preferable to the formidable resection advocated by Kausch.

LIST OF REPORTED CASES OF RADICAL OPERATION FOR PRIMARY TUMOR OF THE AMPULLA OF VATER.

1. Halsted (Bost. Med. and Surg. Jour., 1899, ii, 645): Wedge-shaped piece of duodenum excised with portions of common and pancreatic ducts. Recovery. Ducts transplanted into suture line. Cystostomy. Ten weeks later cysticoduodenostomy. Death nine months later.

2. Mayo* (St. Paul Med. Jour., 1901, June, cit. Quénu; also Col-

* In ANN. OF SURGERY, 1906, xliv, 215, Mayo mentions two excisions of tumors of the ampulla, both primarily successful. But only the one case is mentioned in the later paper in Collected Papers, 1910.

lected Papers, 1910, p. 144): Cystostomy, fistula. Two months later transduodenal resection. Recovery. Alive 18 months later.

3. Czerny-Schüller (Beitr. z. klin. Chir., 1901, xxxi, 687): Transduodenal excision. Cystostomy. Death fifth day, retroperitoneal suppuration.

4. Körte (Chir. der Gallenwege, 1905, 398): Transduodenal excision of adenoma. Drainage of common duct and gall-bladder. Death sixth day.

5. Körte (*ibid.*, p. 223): Duodenocholedochotomy. Eighteen months later circular resection of duodenum. Axial anastomosis. Ducts implanted in posterior wall of duodenum. Death third day.

6. Voelcker-Arnsperger (Beit. z. klin. Chir., 1906, xlviii, 711): Transduodenal excision. Hepaticus drainage. Death second day, hemorrhage.

7. Körte (Arch. f. klin. Chir., 1909, lxxxix, 42): Transduodenal excision. Drain in pancreatic duct passed up common duct and out through hepatic. Recovery. Well 3 years 9 months later.

8. Verhoogen-Quénu (Rev. de Chir., 1909, xxxix, 260): Transduodenal excision of adenoma. Death eleventh day, peritonitis.

9. Cordua (Münch. med. Woch., 1906, liii, 2324): Transduodenal excision. Cholecystectomy and gastro-enterostomy. Recovery.

10. Cunéo-Hartmann (Bull. et Mem. de la Soc. de Chir., 1910, xxxvi, 1342): Transduodenal excision. Gastro-enterostomy. Death fifth day, ascending cholangitis.

11. Morian (Deut. Zeitschr. f. Chir., 1909, xcviii, 366): Cystenterostomy and transduodenal excision. Recovery. Well nine months later.

12. Navarro-Hartmann (Bull. et Mem. de la Soc. de Chir., 1910, xxxvi, 1340): Transduodenal excision. Recovery. Well two years later.

13. Kausch (Zentrlbl. f. Chir., 1909, xxxvi, 1352): First operation: Cholecystjejunostomy and entero-anastomosis. Second operation, two months later: Gastro-enterostomy and exclusion of pylorus. Segmentary resection of duodenum. Suture of duodenum over cut surface of pancreas. Implantation of common duct in duodenum. Recovery. Well one month later.

14. Kraske-Oehler (Beit. z. klin. Chir., 1910, lxix, 726): Transduodenal excision and cystostomy. Recovery. Well three months later.

15. Hotz (Beit. z. klin. Chir., 1911, lxxxvi, 816): Gastro-enterostomy. Transduodenal excision. Recovery.

16. Upcott: Transduodenal excision. Cystostomy. Recovery.

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[1] Morian: Deut. Zeitschr. f. Chir., 1909, xcviii, 366.
[2] Schüller: Beitr. z. klin. Chir., 1901, xxxi, 683.
[3] Hotz: *Ibid.*, 1911, lxxvi, 816.
[4] Deaver: Amer. Journ. Med. Sci., 1912, cxviii, 789.
[5] Navarro-Hartmann: Bull. et Mem. de la Soc. de Chir., 1910, xxxvi, 1340.
[6] Desjardins: Rev. de Chir., 1907, xxvii, 945.
[7] Cotte: *Ibid*, 1909, xxxix, 1135.
[8] Kausch: Zentrlbl. f. Chir., 1909, xxxvi, 1352.

THE CLINICAL DIAGNOSIS OF CONGENITAL ANOMALY IN THE KIDNEY AND URETER.

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IN the literature of the past few years one may frequently find reports of one or two cases of congenital anomaly in the kidney and ureter. The existence of this condition was usually discovered at operation or at autopsy, and no extensive reference was made in regard to the exact clinical diagnosis. With the development of the cystoscope and the radiograph and, more recently, through the discovery of the value of these instruments in their simultaneous employment, as in pyelography,[1] we now have at our command the means to make an accurate diagnosis in practically every case of renal or ureteral anomaly.

The frequent occurrence of congenital anomaly in the kidney and ureter is not generally appreciated. A review of the surgical and clinical records of the Mayo Clinic for the past five years shows that gross renal and ureteral anomalies were found in 36 patients. Of this number, seven were operated for diseased conditions in the abdomen other than those in the kidney, in whom the discovery of the renal anomaly was largely incidental to general abdominal exploration. Eighteen were operated for various pathologic conditions complicating the anomaly. In the last three years we have been able to make the clinical diagnosis of congenital anomaly in 14 patients; of this number, four were not operated for various reasons. Post-mortem records of the last 171 autopsies made at the clinic showed that congenital anomaly of the kidney and ureter was noted in seven cases or over 4 per cent. of the total. This number includes only those gross anomalies occurring in the adult that might be regarded of surgical importance, and does not include minor anomalies so frequently found in

the urinary tract, such as supernumerary and aberrant renal blood-vessels, fetal lobulation, moderate degree of malposition, nor those rather frequent instances of partially deformed or moderately atrophic kidneys which may be due either to congenital or acquired etiologic factors.

The various anomalies in the order of their frequency were as follows: fused or horseshoe kidney, 11; congenital, single, or asymmetrical kidney, 6; atrophic kidney, 5; ectopic kidney, 3; duplication of renal pelvis and ureter, 8; division of ureter, 5.

The surgical records of the Mayo Clinic show 649 operations on the kidney and ureter during the past five years. Excluding the four cases diagnosed and not operated and the seven cases found at autopsy, there remain 25 cases operated, or a proportion of 1 congenital anomaly to 26.

The pathologic condition existing in the anomalous kidney or ureter usually calls our attention, clinically, to its existence. That such kidneys are peculiarly liable to disease has been noted by various observers. The frequency with which such anomaly is found in a surgical clinic as compared with post-mortem records of a general hospital would, therefore, be at least partially explained by the fact that the complicating conditions usually require surgical treatment.

FUSED KIDNEY.

The fused kidney may assume any of a great variety of forms and may be situated in various parts of the abdomen. The type of fused kidney more frequently found is the so-called horseshoe kidney. Although its usual position is in the median abdomen at about the level of the umbilicus, it often lies more to either side of the spine. Occasionally, it will be found lying diagonally, with one pole extending down into the bony pelvis. If our attention be called to the existence of a fused kidney clinically, it is usually because of some pathologic process which causes tumor or localizes pain in the median abdomen. Unfortunately, the *subjective symptoms* caused by various pathologic conditions found in the horseshoe kidney might

easily be confused with the symptoms caused by disease in the surrounding organs. When the complication involves one-half of a symmetrical lying horseshoe kidney, the pain may be more lateral than median, as proved to be the case in three of our series. When the kidney lies asymmetrical, the median lying pole, which is usually the lower, is generally the one involved, with consequent distinctly median pain or tumor. Rovsing [2] has recently described three cases of symmetrical lying horseshoe kidney without visible pathologic changes, which, because of their position, evidently caused pressure on adjacent nerve-trunks. He regarded the resulting pain, referred across the abdomen, appearing on exercise and relieved when recumbent, as pathognomonic. Our series includes one such case, but it was quite impossible to make the clinical diagnosis from the subjective symptoms. *Palpation* may determine a mass lying across the lower median abdomen which is suggestive of a fused kidney but certainly would not identify it as such. Furthermore, in a large or tense abdomen it may be quite impossible accurately to determine a small median tumor such as may be caused by a median kidney. A retroperitoneal mass felt through the rectum may offer corroboratory data, particularly if the pulsation of adjacent large blood-vessels can be determined. This finding, however, can be obtained with various retroperitoneal conditions other than those of the kidney (Fig. 1).

The *radiographic shadow* of soft tissues in the abdomen is usually too inexact to permit of accurate interpretation. Occasionally the outline of a median mass in a thin subject may be suggestive of a horseshoe kidney. Should the radiograph show a shadow of an evident renal stone in the lower median abdomen the possibility of a fused or ectopic kidney would be indicated. Meatoscopy may be of some corroboratory value. In four of the five cases thus examined, the meati were found in their usual position in the trigone. In one, the meatus of the ureter leading to the median lying pole was found in the median line of the trigone. Obstruction to the ureteral catheter at the level of a pelvic mass might be sug-

FIG. 1.

Case No. 10,215. Horseshoe kidney. Hydronephrosis median and lower pelvis. Upper pelvis normal. Kidney resected.

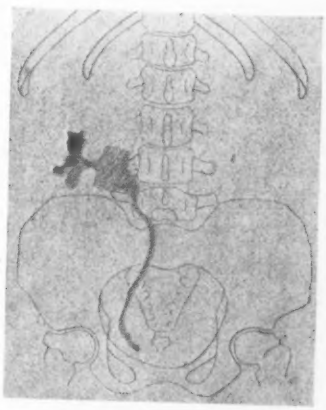
FIG. 2.

Case No. 9508. Fused kidney. *a*, hydronephrosis median and lower pelvis; *b*, upper pelvis normal. Kidney resected.

FIG 3.

Case No. 5244. Congenital single kidney. Note *a*, large pelvic outline; *b*, normal contour of calyces.

FIG. 4.



Case No. 11,926. Ectopic kidney. Note *a*, peculiar insertion of ureter (pelvis situated anteriorly); *b*, duplication of pelvis.

gestive of some renal anomaly. However, more exact data are to be obtained through the combined use of the radiograph and the cystoscope, namely, through pyelography. The relative position of the pelvis is accurately determined, and any complicating dilatation or deformity of either pelvis and ureter can be clearly demonstrated. Within the past three years we were fortunate enough to secure three pyelographs of fused kidneys, all of which were complicated by a hydronephrosis in one of the poles (Fig. 2).

On reviewing the eleven cases of fused kidney in our series, we find that eight were of the so-called horseshoe type and three were so-called sigmoid kidneys, one with three separate pelves. The various conditions found complicating the anomaly were as follows: hydronephrosis, 4; tumor (sarcoma?), 1; renal hæmaturia (essential), 1; abdominal pain, 1; discovered in operating for other abdominal conditions and evidently otherwise normal, 4. The sex was about equally divided, there being 5 males and 6 females. Six of the patients were below 30 years of age, and of these, five were operated for some complication of the kidney itself. This is of considerable interest and is in keeping with the fact that if complications (particularly certain forms of ureteral constriction) occur as the result of congenital anomaly, they will occur in the young adult, usually soon after their full development. The majority of anomalies occurring in patients over 30 years of age was discovered accidentally at the time of operation for some other abdominal lesion. Evidence of congenital anomaly in other organs was found in but one patient, a female, who was found to possess a bicornate uterus.

CONGENITAL SINGLE KIDNEY (FIG. 3).

The diagnosis of the congenital absence of one kidney can be made clinically only by means of the cystoscope, and thus the condition becomes a problem largely of cystoscopic technic. Naturally, the inability to find a ureteral meatus in a markedly inflamed and contracted bladder does not necessarily indicate its congenital absence. In the hands of an

experienced observer, however, the absence of any evidence of a meatus in a bladder which permits of thorough cystoscopic examination would be strong evidence of a single kidney. To further corroborate this, the segregator, if carefully employed, may be of value. The injection of indigo carmine is often of aid in determining the existence of a meatus. Some difficulty may be encountered in differentiating clinically between acquired and congenital single kidney. When a kidney and ureter become functionless, such as occurs with a so-called autonephrectomy, the site of the former meatus will frequently remain visible and show evidence of some inflammatory change. With the congenital single kidney the meatus is frequently situated in unusual positions, either in the median (one case) or extremely lateral base of the bladder (one case). Close examination of the meatus may reveal an hypertrophy of the muscular ring about it. The peristaltic contraction will be found exaggerated. The secretion may be found unusually frequent or with unusual volume.

Of considerable interest is the pyelograph of the single kidney. The injected pelvis of the hypertrophied congenital single kidney will usually appear considerably enlarged but otherwise quite normal in outline.[2] The increase in the size of the pelvis will be commensurate with the increase in parenchyma. On the other hand, with an acquired single kidney, the several pyelographs I have made do not show any increase in the size of the pelvis.

Although a portion of the other ureter has been reported to exist by various observers,[3] in none of the three cases cystoscoped and operated nor in the two cases reported in the autopsy records was any evidence found of the other ureter.

A quantitative estimate of the functional capacity of the single kidney may be of some corroborative value. The phenolsulphonphthalein test is well adapted for this purpose. A very high percentage of the chemical substance secreted, such as usually occurs with two normal kidneys, might be indicative of the degree of compensatory hypertrophy.

Subjective symptoms are of little value.

Palpation.—To be able to palpate but one kidney and to determine an evident increase in its size is at best only suggestive of a single kidney. It must be remembered that one of two normal kidneys is occasionally found considerably enlarged without apparent reason. Frequently it is quite impossible to differentiate hypertrophy from a large normal kidney lying low and prominent in a thin abdomen. It may be difficult to differentiate between a small renal tumor and an hypertrophy. A tumor of the surrounding organs may closely simulate an enlarged kidney. If, however, on exploration in the abdomen, the surgeon finds that one kidney is unusually large without apparent cause, the other kidney should invariably be searched for, and if present carefully examined for evidence of disease.

Of the six cases of congenital single kidney in our series, four were diagnosed clinically and demonstrated at operation. In one case the single kidney was tuberculous and in another the ureter was kinked so as to cause a moderate degree of mechanical obstruction. In but one patient was there any co-existing anomaly, namely, a bicornate uterus, a congenital absence of cervix, vagina, left tube, and ovary. The kidney was found markedly hypertrophied in every instance. This leads one to infer that where no marked hypertrophy is noted, failure to find the other kidney may not necessarily be a congenital defect.

ATROPHIC KIDNEY.

Atrophy of the kidney can be either congenital or acquired, and it may be quite impossible to differentiate the etiologic factors on gross examination. With a marked degree of atrophy of one kidney the other kidney is usually found hypertrophied. The discovery of hypertrophy in a kidney on abdominal exploration would necessitate examination of the other side. The clinical diagnosis of an atrophic kidney may be exceedingly difficult, and when made is largely dependent on systematic data.

A moderate degree of atrophy could easily be overlooked

in a cystoscopic examination. An evident diminution in amount of secretion on meatoscopy could easily be explained by reflex inhibition of secretion so frequently seen as the result of cystoscopic irritation. A qualitative estimate of the functional activity as evidenced by the length of time required for the kidney to secrete a chemical substance previously injected subcutaneously would be of little value so long as any normal kidney tissue is present. By means of a quantitative estimate we should be able to ascertain the functional capacity more accurately than by any other means. Unfortunately, however, with a diseased kidney on the other side the vagaries in functional estimate in the supposedly normal kidney are often so great that even a marked diminution in functional capacity does not necessarily indicate that the kidney in question is incapable of normal functional activity. Although a moderate degree of atrophy may be present without much evidence on cystoscopy, with marked atrophy, we have various data which should call our attention to its existence. Examination of the meatus will show an atrophy of the circular muscle usually seen about the normal meatus. The meatal contraction will be slight, the secretion will be small in amount and seen but occasionally. The other meatus will usually show a corresponding compensatory increase.

Atrophy of the ureter is usually in keeping with the degree of renal atrophy. This is often the case in conditions of reduced renal secretory tissue in conditions other than congenital. Even a small ureteral catheter may meet with difficulty in introduction as a result of atrophic reduction in size of the ureteral lumen. The pelvis of the atrophic kidney, particularly in the congenital, may be so rudimentary that its outline in the pyelograph may be corroborative of the foregoing data.

The patient's general condition, blood-pressure, ophthalmoscopic data, as well as subjective symptoms, should call our attention to the existence of renal insufficiency in cases where the secretion from an atrophic kidney may appear normal. Atrophy of one kidney to such a degree that it would seem impossible to sustain life, and without apparent cause other

than congenital, was found in five patients. In two cases the condition was found at autopsy and in one case it was demonstrated clinically. The kidneys were described as infantile in size and without other apparent evidence to cause their atrophy. The ureter was found small and atrophic in every case.

ECTOPIC KIDNEY (FIG. 4).

Anomaly in the position of the kidney may be acquired or congenital. A moderate deviation from the normal situation or a freely movable kidney is not necessarily considered a congenital anomaly. When, however, the kidney is found lying fixed in the bony pelvis or across the spine and when its blood-vessels come from adjoining vessels, such as the iliacs, it must be regarded as a true congenital anomaly. Such a kidney is called an ectopic or pelvic kidney. Its clinical diagnosis is easily confused with various conditions in the surrounding organs. Subjective symptoms are usually referred to the lower abdomen and pelvis. On abdominal palpation the ectopic kidney may readily be mistaken for an appendiceal mass or a tumor of the adnexa. On rectal examination it may, in some cases, be felt as a retroperitoneal mass, and when large blood-vessels are felt with it the finding may be of value. However, the only accurate method of establishing the diagnosis clinically is by means of the cystoscope and the radiograph. On cystoscopy an anomalous position of the ureteral meatus may be present. The ureteral catheter can usually be introduced but a short distance. The position of a metal stilette or catheter as shown by the radiograph would localize the position of the kidney, providing the stylet can be introduced into the pelvis. More graphic and complete, however, is the pyelograph, which not alone localizes the position of the kidney but also demonstrates any anatomic peculiarities in the renopelvic outline. It must be remembered that the relative position of the two pelves of an asymmetrical fused kidney, one lying in a normal position and the other lying low in the median line, might simulate the relative position of the pelves of a normal lying and ectopic kidney.

Since it is the existence of some pathologic condition which calls our attention to the anatomic anomaly, it is even more important that we demonstrate this complication clinically. The data obtained through the cystoscope and ureteral catheter alone will aid us materially in ascertaining the identity of the complication. The pyelograph will usually be found to be of greater value, however, to determine accurately the position and extent of any pelvic distention, whether mechanical or inflammatory, and to demonstrate any deformity resulting from inherent tumor. The most common complication associated with the ectopic kidney is hydronephrosis, evidently as a result of its anomalous position.

Ectopic kidney was found in three patients in our series. This number does not include those numerous instances where the kidney was found lying low in the abdomen nor even those freely movable kidneys found in the bony pelvis. It includes only such as were fixed in the bony pelvis and whose blood supply came from the adjoining vessels. As various observers [4] have noted, malformation of the various genital organs frequently occur with such a kidney.

ANOMALIES OF THE URETER (FIG. 5).

Duplication of the Pelvis.—That the normal renal pelvis may assume any of a great variety of shapes is well known. The individual calyces may be so large and so situated that they resemble separate pelves, particularly so when the calyces do not unite until well beyond the hilum. When, however, there are two distinct pelves within the hilum and each has its separate calyces and ureter, the condition must be considered as an anomalous duplication of the pelvis and becomes of practical importance. Our series includes eight cases of duplicated renal pelvis, five of which were operated upon, one was found at postmortem and two were demonstrated clinically but not operated. In the six cases explored evidence of a division of the two halves of the kidney was externally visible, varying from a slight depression to a distinct area of demarcation. The division is furthermore indicated in cases of true

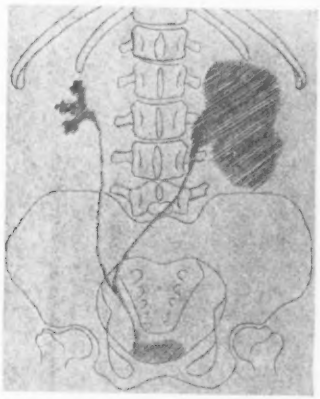
FIG. 5.

Case No. 10,962. Duplication of the pelvis of right kidney and ureters. Normal. Accidental discovery in routine clinical examination.

FIG. 6.

Case No. 13,529. Bilateral duplication of ureters and pelves. Duplication left kidney pelvis complete with small hydronephrosis and stone of the lower pelvis. The two pelves of the right kidney united by common calyx.

FIG. 7.



Case No. 11,425. Division of ureter at lower third. Left branch crosses spine and leads to a large hydronephrosis of the left kidney. Right kidney normal. Pyelograph obtained by using large catheter and inserting short distance into meatus.

duplication by the fact that the individual poles of the kidney will have in the main a separate blood supply. For practical purposes, therefore, the kidney might well be considered as made up of two distinct kidneys which will permit of separation if necessary. Bisection of such a kidney was performed successfully in three instances by W. J. Mayo after the clinical diagnosis had been made. In one case duplication of the pelvis with separate ureters was found on both sides. In the right kidney the two pelves were united by a narrow calyx in common with both. This connection was suggested by injecting methylene blue solution into one ureter and its return through the other. The separation of the pelves in all other cases was complete. The diagnosis of the pelvis duplication can be made accurately only by means of the cystoscope and radiograph combined. The finding of two separate meati on one side of the base of the bladder on cystoscopy does not necessarily indicate the existence of separate pelves, since the two ureters may unite above the bladder. Neither would two catheters introduced into separate ureters necessarily establish the existence of a duplicated pelvis, since a single pelvis may have two distinct ureters. The pyelograph offers the most accurate means to determine the relative position of the pelves and the amount of renal parenchyma separating them. Furthermore, it will determine the character and extent of any pelvic deformity which may result from some pathologic condition affecting that part of the kidney. The various pathologic conditions affecting the half of the kidney and necessitating operation were as follows: hydronephrosis resulting from anomalous blood-vessels constricting the ureter near the ureteropelvic juncture, 2; hydronephrosis resulting from stricture at the wall of the bladder, 2; hydronephrosis and stone, 1.

Duplication of Ureter (Fig. 6).—In seven of the cases of duplicated pelvis in our series the two ureters were found separate along their entire course and leading into separate meati in the bladder. In one case the two ureters were found lying in close apposition within a distinct sheath for a distance of about 6 or 8 cm. along their middle third, but without any

evidence of anastomosis. The position of the two meati in the four cases cystoscoped and diagnosed was found to be variable. In two cases one meatus was found at about its normal position while the other meatus was situated posterior and more median about 3 cm. apart. In the other two cases the distance separating them was about 1 cm. The stilette or pyelograph will graphically demonstrate the usual crossing of the ureters at the brim of the pelvis. In one case we were able to demonstrate clinically complete duplication of the ureter on both sides, with partial duplication of the pelvis of the right kidney and complete duplication in the left kidney.

Division or Partial Duplication of the Ureter.—The ureter may divide at any part of its course. The most frequent point of division is at the first portion of the ureter where two more branches of the ureter leave the hilum and unite at a short distance below. Often, however, this will not be a true ureteral division but will represent the absence of a true pelvis with the union of extended infundibula instead. Division of the ureter into two branches ending in adjoining meati is occasionally met with. This division may occur along any part of its course, more often in the lower portion. Union of the two ureters arising from normally situated kidneys and merging at about the brim of the pelvis and entering a single meatus on the right base of the bladder was found in one case of our series. This series includes five cases of division of the ureter; one case of double pelvis with two separate ureters joining a short distance below the hilum; one case of three ureters leaving a single large pelvis at various angles of the kidney and uniting at a short distance below, which was found at autopsy; two cases of division of a single ureter at the brim of the pelvis entering separate meati on the same side; one case of union of the two ureters arising from separate kidneys at the brim of the pelvis as described above and which was diagnosed clinically by means of the injected radiograph (Fig. 7).

The clinical diagnosis of duplication of the ureter can usually be made quite easily by means of inserting metallic coated catheters into the individual ureters and then making

a radiograph. This was done in three of our series of duplication. It will be found more difficult and often impossible, however, to so diagnose the divisions of the ureter. With division of a single ureter above the meatus it will be found necessary to inject fluids opaque to the X-ray in order to demonstrate the condition. This we were able to do in two instances. Furthermore, the injected radiograph will usually aid us in ascertaining the existence of any complicating lesion such as stricture of the ureter and hydronephrosis.

The following complications were found in the cases of division of the ureter: hydronephrosis in a kidney with one ureter uniting with the ureter from the opposite kidney, 1; stone in ureter above point of lower division, 1; stricture in ureter at bladder, 1.

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THE OPERATIVE PROCEDURE IN CANCER OF THE PROSTATE.*

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In operating for cancer of the prostate it is customary for the surgeon to proceed just as he would were he dealing with senile hypertrophy. A prominent feature of the operations dealing with the latter condition, and one on which great reliance is placed, is that of enucleation. A skilled operator, after a senile hypertrophied prostate is once exposed through dissection, has no further use for the knife in effecting removal. He accomplishes his purpose through enucleation, the offending mass being removed thereby often in one, and very rarely in more than two or three pieces. A smooth, fibrous sheath encapsules for the most part these pieces. In a minority of cancerous cases, representative of instances wherein malignancy has engrafted itself as a secondary process onto a previously existing senile hypertrophy, the surgeon in operating can successfully employ enucleation, provided the growth has not already extended itself as an infiltrating process beyond the confines of the encapsulated prostate. In a large majority of cases, however, cancer attacks the prostate as a primary pathological process, and by the time such a case is placed on the operating table, the disease has involved not only the prostate but surrounding or adjacent structures as well. It is very unusual for the trigonum and vesical neck to have escaped involvement in these conditions. Consequently it is beyond the expectation of the operator in most instances to be able to accomplish such a radical removal of the growth that there will be no recurrence. His real purpose rather would be to so thoroughly remove the cancerous prostatic obstruction that there would be not only a free voidance of urine after the

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operation, but also that such voidance should remain thereafter as long perhaps as the patient might survive, death resulting from an extension of the growth into another vital direction. In cases of this description the scirrhous element is commonly present in greater or less degree in connection with the neoplasm. When an operator, after exposing the prostate either suprapubically or perineally as the case may be, tries to effect removal through enucleation in such a condition he will be unable to find any line of cleavage. Through the exertion of much force he may be able to tear away irregular and ill-defined masses. In most cases, however, detachment cannot be accomplished in this manner without the aid also of cutting forceps and scissors. The result of such a procedure is the establishment through the growth of a urinary outlet, the walls of which are necessarily ragged and irregular. Some time ago, operating in this manner by way of a suprapubic incision, I encountered a cancerous prostatic growth of considerable size, the removal of which was essential. I found the operation difficult, as the tissue, besides being scirrhous, was brittle and unyielding. With the use of scissors and forceps I separated the mass as much as possible, thereby reducing to a minimum the work of forcible removal through the digital manipulation commonly used in connection with enucleation. In this case I was appreciative of the danger, while using digital force, of tearing the rectum, and consequently directed my efforts to guard against such an accident. All of a sudden the brittle tissue gave away laterally and the mass was free. With the removal there was severe hemorrhage. I found that the sudden giving away laterally had been occasioned by a tear through the brittle tissue, and that this tear had radiated unduly beyond the line of separation, the result being that a large pelvic vessel had been opened. The hemorrhage in this instance was fatal, as it could not be effectually controlled. Although I had long felt that the employment of forcible separation or traction in accomplishing removal in these cases had elements of danger which did not exist when the same forces were carefully applied in effecting enucleation of hypertrophies in benign cases where

the surrounding tissues were natural and elastic, still this experience was sufficient to cause me to abandon the usually prescribed technique and to inaugurate the method to be now described. The object of this method is to place a minimum reliance on forcible separation and traction, at the same time correspondingly augmenting the employment of cutting devices.

The operation is as follows: First of all the area of the prostatic obstruction is exposed to inspection and manipulation in the greatest degree possible through the simultaneous employment of both a suprapubic and a perineal opening. This accomplished, what I will describe as a boat-shaped section of the growth is removed. The initial step in effecting this removal is the introduction through the perineal opening of a long-bladed, straight, blunt-pointed bistoury. The end of this instrument enters the bladder by way of the prostatic urethra. The knife thus lies above the middle portion of the obstruction. Through the suprapubic opening the knife can be observed and consequently accurately placed so that its end is brought beyond the intra-vesical limit of the growth, and made to assume a correct position in the middle line with its blade turned downward. The patient being now in the lithotomy position, the operator with his right hand grasps the handle of the knife protruding from the perineal opening, while his left forefinger is introduced into the rectum, its ball being turned upward and made to touch the bowel wall in the middle line under the prostate. The operator then cuts through the prostatic mass down to or nearly to the bowel wall, the left finger tip warning him as to how far he should go. This cut represents, as it were, the keel to the boat. At the bottom of this cut the knife, without being withdrawn, is rotated so that its blade assumes a position to the right and at right angles with its former downward position. The left hand is then introduced suprapubically into the bladder, and the tip of its forefinger brought in contact with the blunt-pointed end of the knife, the right hand still holding the handle. Under such guidance a right elliptical incision is made, so that when the incision is finished the knife blade is left facing upward. The knife is next replaced into

the bottom of the first cut, which represents the keel of the boat, and a left-sided elliptical incision made exactly similar to that on the right. These two lateral incisions represent the body or belly of the boat. The two lateral pieces are now adherent along the line of, as it were, the gunwale. In the final detachment, scissors are first introduced through the suprapubic opening and cuts made on either side along the gunwale line as far as can be. Then, the patient being again put in the lithotomy position, the scissors are introduced into the perineal opening and made to cut on either side along the external lines of the gunwale. With the meeting of the ends of these lateral scissor incisions the two pieces which go to make up the boat-shaped mass are thoroughly detached, and can be extracted by forceps through the suprapubic opening. While using the scissors, especially suprapubically, moderate traction on a lateral piece through forceps is required, but the force so exerted falls far short of that required in effecting a separation without cutting instruments, and is never sufficient to tear tissues. It can, of course, be argued against this method that there is little in the way of radical removal accomplished through its employment. In answer to such an argument I would state that although the method does not attempt to be so radical as some others, still it is in its results as radical as any, besides having apparently a greater element of safety through an avoidance of certain dangers. Sometimes an operative method introduced in order to avoid dangers will be found objectionable on account of the new dangers which it introduces; but that objection cannot be raised against this procedure. There might, of course, be danger of severe or fatal hemorrhage while making the latter elliptical cuts. To avoid this I would recommend keeping within the general confines of the cancerous growth, and not trying to make a cut wide enough to get into unaffected tissue beyond. In fact, the operation is not advised for cases where a growth is so circumscribed as to be confined largely to the prostatic limits, but for cases in which the surrounding structures have become to a considerable degree secondarily involved. In cutting through

cancerous tissues, especially of scirrhous consistency, little hemorrhage is commonly encountered, provided, of course, the track of large vessels is avoided. This operation is accompanied by less degree of shock than is one associated with greater manipulative effort in connection with the removal of growth. As the seat of cancerous removal has a clean cut margin, void of tissue laceration, there is less danger of post-operative sepsis and of vesical incontinence. In fact some cases have had no such incontinence, and in most of them it has not been a marked feature.

A case leaves the operating table after this procedure with both a suprapubic and a perineal vesical drainage tube. About the perineal tube is gauze packing which fills up the space left by the growth removed. An end of the packing protrudes from the perineum to facilitate its extraction. The packing and the perineal tube are usually removed on the fourth day. The suprapubic opening is closed, with the exception of the space left for the drainage tube. This last tube is removed on the seventh or eighth day.

I have made use of this operation in eight cases, and have had no operative mortality in connection with it. The length of life following removal of cancerous prostatic obstruction wherein no expectation is entertained that all of the growth has been eliminated varies from a few months to one year as a rule, with exceptions wherein the period extends beyond a year and perhaps up to two years. This period depends upon the quality and rapidity in development of a growth. Were this short extension of life the only argument to be advanced in its favor, it is probable that few would submit to operation. It is the great pain and distress due to the resulting vesical retention which cannot be relieved by catheterization that drives a patient to seek relief from operation. Although it is possible that there may be a recurrence of retention later on, owing to re-formation or extension of a growth, still such a happening is not frequent, and should it occur the track of the suprapubic cystotomy can be opened and maintained as a vent. The usual history of these cases after the removal of prostatic obstruction is a period of comfort until such time as the cancer

through its extension causes disturbance elsewhere. If the bowel be thus invaded, or the liver, there will of course be developed symptoms such as accompany the disease when so situated. A not uncommon direction of extension is along the bladder floor. When this takes place it is usual for the ureteral orifices to be involved and eventually occluded. Such a happening will cause first hydronephrosis, and if this be not relieved then death. Death from acute uræmia due to unrelieved hydronephrosis of this description is not painful. The uræmic poisoning generally causes a blissful torpidity, and if it occasions delirium the mental disturbance is oftentimes of a happy trend, or at least not indicative of suffering. It is, of course, perfectly possible to avert this last complication and to still further successfully thwart the disease through the performance of double nephrostomy, thus giving urine a vent at the loins. This second operation has not, however, the powerful argument in its favor that the first one had, namely, the relief of great bodily pain and distress; the only point in its favor being a further prolongation of life, and that for probably but a brief period. I have met this last issue through the performance of double nephrostomy on five occasions; I prolonged life in one case three months, and in another two months; two desperately uræmic died promptly after operation, and one lived two weeks. From an operative standpoint the one who lived three months was a great success, but from other points of view there was nothing gained. What I did was to bring an individual who had passed into blissful uræmic state back to a full realization of his bodily condition and suffering. This man never thanked me for what I last did for him, and his death was after the short interval less placid than it would have been had the uræmia been allowed to progress.

It seems to me that the only real argument in favor of nephrostomy in this connection would apply to a special case where there was some very strong or valid reason,—such as the making of a will,—for the brief mental and bodily respite offered. In all other cases I feel that I should not urge this final procedure.

THE TREATMENT OF FISTULA IN ANO,*

WITH ESPECIAL REFERENCE TO THE WHITEHEAD OPERATION.

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A CAREFUL study of the literature of fistula in ano leaves one with the feeling that the surgical treatment employed in many of these cases is not productive of satisfactory results. It should be borne in mind that it is not merely the cure of the fistula which is desired but that in addition the patient should be left with a rectum as nearly normal in function as possible. It not infrequently happens that after an operation for fistula in ano, the last state of the patient is much worse than the first, especially if more or less marked incontinence of fæces results.

It has for a number of years been the writer's endeavor to perfect a method of operating upon these conditions which would at the same time insure healing of the fistula within a reasonably short period of time and leave the patient with as nearly a normal rectum as possible. From a careful study of more than one hundred consecutive cases of fistula in ano, the writer has been able to draw some personal conclusions as to the etiology, pathology, treatment and results of such treatment. Very often regarded as essentially minor surgery and in many cases comparatively easy of cure, fistula in ano may assume such extensive and serious characters as to test the highest surgical skill and necessitate operations of decidedly major proportions.

The classification of fistulæ into complete and incomplete is of no particular importance, dependent as it often is upon the ability to demonstrate a communication with the bowel. Such communication exists in a great majority of cases even

* Read before the American Surgical Association, May 29, 1912.

though in many instances it may be microscopical rather than macroscopical.

The existence of fistula presupposes some antecedent infection and necrosis which in the great majority of instances is a simple pyogenic infection.

Tuberculosis plays only a comparatively insignificant rôle in the causation of this condition. The relatively high percentage of tuberculous fistulæ in ano given by some writers is undoubtedly based rather upon a clinical than upon a bacteriological or histological diagnosis. The more that careful laboratory methods are employed in the study of fistula in ano, the smaller the tuberculous percentage grows. Furthermore, in the majority of the tuberculous cases, the condition is usually secondary to some other demonstrable tuberculous lesion elsewhere in the body rather than the primary focus. No period of life is exempt from the affection, for fistulæ in ano are observed from the earliest infancy to advanced old age. Most fistulæ originate from within the bowel, only comparatively few having their origin from without the bowel. The majority of fistulæ originate in an infected hemorrhoid. The sequence of events is first a small thrombus, either infected or non-infected. In the latter variety infection soon occurs. Through the lymphatics the infection extends to the non-resistant perirectal fat and presently a perirectal abscess presents and opens either externally or internally or in both directions. If the principal opening is external the internal opening may be scarcely more than microscopical, but the examining probe is often found to pass into a hemorrhoid and it is this opening which usually determines the chronicity of the process. In other instances a fissure, ulcer or superficial abrasion is the portal of entry for the infecting micro-organisms, and in still other cases there is no demonstrable portal of entry. In some instances ulcerative processes well up the rectum may be the starting point of fistulæ, but it also sometimes happens that the infectious process originates low down in the hemorrhoidal area, extends upward around the rectum and perforates into the bowel two or three inches above the

anal margin. Examination of such a case some time after the development of the fistula may lead one to suspect a high origin for the fistula when in reality it is low down, and possibly concealed in an insignificant hemorrhoid.

It is fortunate that the internal opening of most fistulæ is between the external and internal sphincters and the satisfaction which follows most methods of operation employed depends upon this fact, necessitating, as it does at the most, damage only to the external sphincter. A considerable number of fistulæ, however, have their internal opening above the internal sphincter, and it is this variety which the surgeon finds most difficult to cure without more or less serious impairment of rectal function. Many fistulæ have a decided tendency to ramify in the loose fat and tissues about the rectum and buttock and it is these manifold and intricate ramifications which contribute so much to the difficulty of satisfactory surgical treatment.

Two cardinal principles should underlie the treatment of fistula in ano, first the separation of the fistulous tract or tracts from the communication with the bowel, and secondly, the adequate closure of that communication with the removal of all the diseased tissues in the rectum. These measures having been employed, there is no occasion for an extended and complicated dissection and removal of all the ramifications of the fistulæ, for with adequate drainage externally upon the skin, they will tend to heal. The chronicity of fistulæ in ano is not dependent upon the lack of drainage but rather upon a communication with the bowel and the failure in many instances to recognize that such a communication may not be macroscopically demonstrable. The secretions of fistulæ find their way to the external or internal orifices with comparative ease, and only rarely does any marked retention of secretion occur, and when it does occur, it usually indicates an acute exacerbation of the infectious process. There is no reason why fistulous processes in the tissues about the anus should heal in any way differently than in similar tissues in other parts of the body, provided that the source of the infection is eliminated.

The various theories advanced to explain why under the old methods of treatment many fistulæ did not heal are hardly rational. If the mucosa of the bowel did not feed the fistula, there is no reason why the sphincteric action should prevent healing, for the normal activity of the sphincters is not vigorous enough to affect tissues several inches distant and it requires some stretch of the imagination to understand how it could very seriously affect the healing even of tissues near the sphincter.

It should also be borne in mind that the surgeon is not always responsible for the weakness of sphincteric action which sometimes follows operation for fistula, for it does now and then happen that the more or less extensive infection, associated as it is with necrosis, causes a destruction of a part, and sometimes of a considerable part, of the sphincter muscles. In such a case, no matter how skilfully injury to the sphincters may be avoided, more or less marked incontinence of fæces may follow, which the patient is inclined to attribute to the operation. Occasionally, too, the extensive perirectal inflammation may subsequently, after a fistula is cured, cause more or less cicatricial contraction about the anus or lower rectum, with some degree of stenosis or stricture. This condition, too, is not always to be attributed to the operative procedure employed.

It should always be the surgeon's endeavor to avoid if possible any injury to either the external or internal sphincter, for only in this way can any definite assurance be had that the subsequent sphincteric function will be satisfactory.

The treatment of fistula in ano can be divided into the conservative or non-operative and the radical or operative. Among the more commonly employed of the conservative measures may be classed the various forms of injection, such as silver nitrate, carbolic acid and other escharotics. The use of bismuth paste may also be properly classed under this heading. While this method has some advocates and in certain selected and mild cases may produce a cure, it is hardly to be considered as an important method of treatment. The elastic ligature is also essentially a conservative measure, and while it in times past

had some enthusiastic advocates, it is essentially obsolete to-day and is in no wise comparable in its efficiency to many other surgical procedures.

The radical or operative methods of treatment may be classified under three headings: (1) incision; (2) excision; (3) excision and suture.

When the fistula is of the submucous variety and does not in any way involve the sphincters, incision often gives satisfactory results. In more extensive and complicated cases, it necessitates cutting one or both sphincters and for this reason alone should if possible be avoided. Excision either with or without suture is better adapted to the more extensive forms of fistula in ano and various modifications of the procedure have been recommended by different surgeons. The essential feature of this type of operation is the attempt to eradicate by clean dissection the fistulous process and to close by suture the communication with the bowel. Against this operation may be urged the difficulty in many cases of determining the communication with the bowel as well as the difficulty encountered in the attempt at dissection of all the fistulous ramifications. It also not infrequently happens in this type of operation that serious damage is done to the sphincters. Another disadvantage of this method is the more or less protracted post-operative treatment which some of these cases require, as well as the fact that it does not provide for the relief of the diseased condition of the rectum which so often precedes and accompanies fistula in ano and to which a great majority of the cases are essentially due.

While the treatment of practically every other surgical malady has been improved in the past few decades, the treatment of fistula in ano remains about where it was twenty years ago and the general results of such treatment are but little if any more satisfactory than they were then.

Failure and unsatisfactory results led the writer several years ago to endeavor to devise a method of treatment which would be general in its applicability, easy and safe in its performance and sure in its results. Long a firm believer in the

efficacy of the Whitehead principle of operation in the treatment of benign surgical conditions of the lower two inches of the bowel, it was but a step to the application of this principle to the treatment of fistula in ano.

The operation consists, first, in a thorough dilatation of the rectal sphincters, laterally, as this has been shown to produce less disturbance of the bladder function than when done anteroposteriorly. With a probe the general course of the sinuses is located and the communication with the bowel determined, if one be demonstrable. A circular incision at the junction of the skin and mucosa is then made and the bowel dissected away from the external and, if necessary, the internal sphincters, which are carefully pushed upward and away from all possibility of injury. The dissection of the bowel is continued upward until well above the level of the internal opening, if one exists, or to the attachment of the levator ani muscle if no internal opening can be demonstrated, care being taken to keep as near the mucosa as possible. In this way complete separation of the fistulous tracts from all communication with the bowel is effected. The external fistulous opening or openings are then somewhat enlarged, and with a small curette all the demonstrable fistulous tracts are carefully curetted. Counter openings in the skin are made in tortuous complicated fistulous tracts if necessary. With interrupted silk sutures, the bowel, mobilized and cut off above the level of the internal fistulous opening, is approximated to the skin at the anal margin, the sutures being placed in such a way as to obliterate all dead space.

In cases where no internal opening can be demonstrated, the dissection of the bowel is never carried above the insertion into the rectum of the levator ani muscle indicated by the so-called "white line," for comparatively few fistulæ ever extend above the attachment of the levator ani muscle to the bowel. The fistulous openings are lightly packed with gauze and a rectal plug is inserted for a few hours to control oozing and insure approximation of tissues and the operation is completed. The fistulous openings are kept open with gauze for a

few days and then allowed to take care of themselves, no particular treatment being required after the first week or ten days. The bowels are moved with a mild cathartic at the end of forty-eight hours, the silk sutures come away of their own accord.

In some cases of extensive and complicated fistulæ, it may require several weeks for all of the sinuses to heal completely, but when this has occurred, there has never been any tendency to recurrence. By this procedure every possible requisite for rapid healing has been fulfilled; the internal fistulous opening rapidly and securely closed; all communication with the fistulous tracts severed; hemorrhoids and other diseased conditions removed; the sphincters preserved intact and a comfortable and rapid convalescence assured. By this method fistulæ communicating with the bowel more than three inches above the anal margin have been cured, with preservation of normal sphincteric function.

It is always well to avoid operating for the cure of fistula during the acute stage of inflammation. In such cases it is well to freely incise the infected area, and, when the active process has quieted down, the radical operation can best be employed.

The above method has been employed in 105 consecutive cases upon which this report is based. In all of these cases careful histological examination of the tissue removed was made at the Bender Hygienic Laboratory. Of this number 96 were found to be histologically non-tuberculous and 9 histologically tuberculous. Of the 9 tuberculous cases, 7 had demonstrable pulmonary tuberculosis at the time of the operation. Of the 105 cases, 64 occurred in males and 41 in females. Arranged according to age, 2 occurred in the first decade; one of them in a child of 10 months; 8 occurred in the second decade; 37 occurred in the third decade; 30 occurred in the fourth decade; 15 occurred in the fifth decade; 10 occurred in the sixth decade and 3 occurred in the seventh decade.

In practically all of these cases it has been possible to trace

the subsequent history of the patients, and in all of them, so far as we have been able to determine, the fistulæ have healed and remained well. Some of the patients have died, but none from causes associated with the fistulæ except in the cases of pulmonary tuberculosis, four of whom have died. There was no mortality associated with the operation. In one case an abscess formed in one of the ramifications of the fistulous tract, which required incision about one month after the operation, but which subsequently healed and has remained well. This was the only case in which any kind of a second operation was required. Some of the cases had been previously operated upon unsuccessfully elsewhere and some damage done to the sphincters. In seven of the cases some degree of stenosis or stricture developed subsequently, but all of these were cases with very extensive perirectal inflammation and necrosis, in most instances associated with bowel openings from two or three inches above the anal margin. The use of hard rubber rectal dilators inserted by the patient once or twice daily effectually relieved the stricture in all of the seven cases, so that at this time none of them have occasion to use the dilators. These strictures were but the natural result of the extensive scar tissue due to the widespread inflammation. One of these cases now has marked incontinence of fæces due to an almost complete degeneration of the external sphincter muscle associated with partial degeneration of the internal sphincter. Three others of these seven have more or less incontinence of fæces, when the bowels are loose, due, so far as can be determined, to the same cause. The remaining cases of the entire series have practically normal sphincteric function.

From several years' study and experience in the treatment of fistula in ano, it may be concluded:

1. That probably not more than ten per cent. of fistulæ in ano are tuberculous and that a great majority of these are secondary to demonstrable tuberculosis elsewhere in the body, usually in the lungs.

2. That the great majority of fistulæ in ano originate from

a diseased condition of the rectum, existing in the lower one and one-half inches, and that this diseased condition is usually a hemorrhoid.

3. That the essential principles underlying the cure of fistulæ in ano consist in:

(a) the severance of the communication between the bowel and the fistulous tract and

(b) the removal of the diseased portion of the bowel, including the fistulous opening.

4. That a widespread and often destructive dissection and removal of the fistulous tracts in the perirectal tissues is unnecessary.

5. That it is possible to cure fistulæ in ano without injury to the sphincters and with a preservation of all the sphincteric function possessed prior to operation, by the application of the Whitehead principle of rectal excision.

SALVARSAN AND NEO-SALVARSAN; THEIR INTRAVENOUS INJECTION.

BY EDGAR G. BALLENGER, M.D.,
AND
OMAR F. ELDER, M.D.,
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NEARLY all who have used salvarsan in the treatment of syphilis assert its extraordinary potency as an antisyphilitic remedy and its comparative harmlessness and painlessness when properly administered. Having seen a number of reports and descriptions in recent books where more or less crude methods of intravenous injections have been recommended, we thought it not out of place to describe the technic evolved after 860 administrations, which in our hands, at least, has greatly facilitated the introduction of salvarsan or any intravenous medication.

All, too, who have had any considerable experience with salvarsan admit the necessity of repeating the injections if uniform and permanent results are to be expected; therefore we should make the administrations as pleasant and painless as possible in order that the patients will readily return for subsequent treatments to complete the cure and prevent recurrences. We believe furthermore that neuro-recurrences can be avoided entirely if the injections are repeated at proper intervals until an adequate course of treatment has been administered. The freedom from the nerve affections in our patients is due, we think, to the fact that all patients were advised to follow even the most satisfactory temporary cures with subsequent injections to clinch the good obtained, and thus if possible render it permanent. That the majority have subsequently been cured we have no reason to doubt, though all have been urged to report, from time to time, for two or three years for Wassermann blood tests and careful physical examinations. The charge made was never so much per injection but for the *course of*

treatment of syphilis and for the subsequent observation to determine if the cure was lasting. All were informed that, at the present, nothing but the time test could be accepted as proof of cure. No additional charge is made for subsequent examinations and treatment except for the cost of the salvarsan. This agreement was made in order that we might keep closely in touch with our patients and thus see the majority of recurrences or unsatisfactory results if they should develop. As all but two of the patients treated have been in private practice we think that the small number of recurrences seen may be taken to mean that the majority of the patients who have not reported have remained free from evidences of the disease. Most of the patients have written, or have returned at intervals for examinations and for blood tests. In the course of these examinations we have occasionally observed suspicious lesions, glandular enlargements or positive Wassermann tests after what we first thought to have been an adequate course of treatment. In this manner we were enabled to anticipate recurrences and prevent more evident manifestations from developing.

A very impressive lesson was taught one of us by the first patient he saw treated with salvarsan. The patient desired to receive the treatment before the remedy had reached this country, so he was carried to Berlin, where a well-known physician administered a subcutaneous injection of salvarsan. All of the manifest lesions quickly disappeared and the patient gained about 20 pounds in weight. So well did he feel that he would not inconvenience himself by coming for a blood test or examinations. In about three and a half months a profuse macular rash developed upon his body and limbs and many mucous patches appeared on his tongue and buccal cavity. The throat, too, was much inflamed. An intravenous injection of salvarsan was administered and within three days all the lesions had healed quite as wonderfully as they did after the first treatment. Likewise three facts were indelibly impressed upon us: first, that a single dose could not be depended upon; second,

that the intravenous method was much superior, as subsequent injections could be given with the assurance that most of the remedy had been eliminated, as no masses were left as in the subcutaneous and intramuscular methods; third, that the spirochætæ are not rendered immune to salvarsan when they are protected and escape its destructive action. This recurrence developed during the first month of our use of salvarsan and showed in a striking manner both the *value* and *necessity* of repeating the injections and thus were we disillusioned almost at the beginning of our use of salvarsan of the hope that a single injection could be relied upon to effect a cure. From then on we urged that the injections be repeated monthly until the cure was complete. Learning early the value of repeated injections we think has been the cause of our freedom from neuro-recurrences, which to us seem due to insufficient treatment. This at least seemed clearly proven in the only instance in which we have seen anything resembling a nerve recurrence. This case was reported in detail before the Medical Association of Georgia, April, 1912. The patient was thought to be in the beginning of the secondary stage with a very faint macular rash over the body; the history, however, was not clear. An oculist demonstrated a beginning optic neuritis 21 days before the first injection of salvarsan was administered. The dose was repeated in a month. All external evidence of disease disappeared. Five weeks later typical optic neuritis developed. More salvarsan was given with mercurial inunctions and potassium iodide, which caused distinct improvement in the vision of the diseased eye. Treatment was neglected later and the neuritis grew worse; more treatment made it better. It was clearly of syphilitic origin, and apparently in some manner sensitized by the inadequate dosage of salvarsan.

The danger of small doses was also shown in another instance where only .3 gramme was administered (on account of a mitral regurgitation) to a syphilitic with optic neuritis; the vision was much worse within two weeks. Two large doses were then administered which resulted in improvement in the

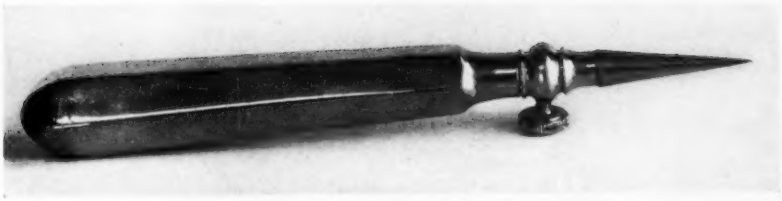
vision to the point it was before the treatment; it then remained stationary. No ear lesions have developed in our patients after treatment with salvarsan, though a number have had their hearing restored by it.

TECHNIC

Telltale scars in the region of the elbow where incisions were made to insert the needle into the veins, in case they were too small for the expeditious insertion of the needle directly into them, soon caused patients to complain bitterly that they could not roll up their sleeves, bathe in the athletic clubs, or expose their arms at home without proclaiming the fact that they had syphilis.

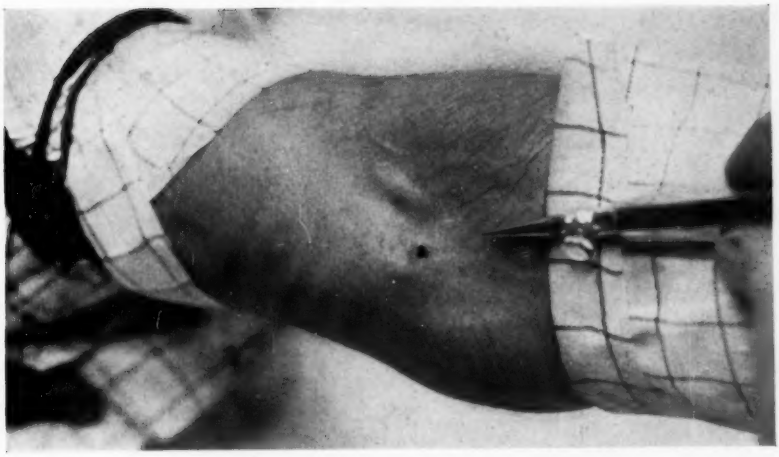
To overcome the difficulty of an accurate introduction of the needle in patients who were fat or had small veins various expedients have been tried: first, we used a small, short trocar and cannula, pulling the skin from over the vein, while the insertion was made through the skin, in such a manner that when the skin was released and the trocar removed, the cannula came over the vein and enabled us to pass the needle through it into the vein without the pressure otherwise necessary to carry the needle through the skin. The cannula was not introduced into the vein but only down to it. This method led us later to insert the needle through the skin while it was pulled aside, not trying to enter the vein until the skin had been previously punctured. Finally we devised a small stiletto (Fig. 1), which we now use in the following manner: The skin is pulled aside, so as not to enter the vein, and a small hole is pushed in it so as to make a little "window," directly over the vein (Fig. 2), when the skin is released. The hole should be about twice the diameter of the needle to be inserted; rarely does even a drop of blood escape from this slight wound, as the tissues of the skin are merely pushed apart. With the vein well distended, and often visible through this hole, it is a comparatively easy thing to insert the needle through the anterior wall into the lumen of the vein. Without some such opening the pressure required to carry

FIG. 1.



Stiletto for making small hole in the skin over the vein.

FIG. 2.

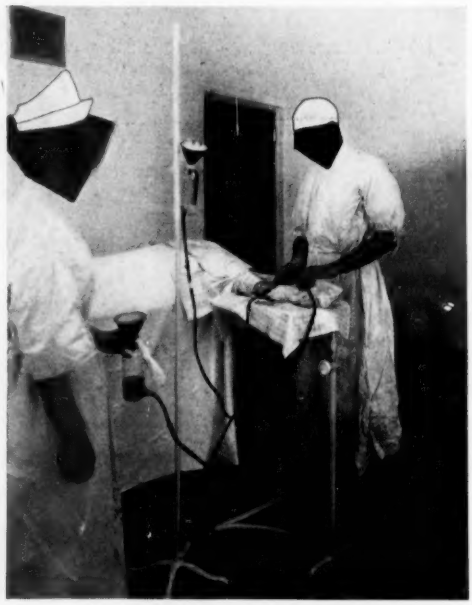


Showing hole pushed through the skin over the vein.

FIG. 3.

Showing apparatus, veins distended and needle about to be inserted into vein.

FIG. 4.



Vein has been entered, blood has been allowed to flow into tube with salt solution, tourniquet removed and solution being elevated to determine if the needle is properly placed in the lumen of the vein.

the needle through the skin and wall of the vein at the same time flattens the vein to such an extent that the needle is likely to pass also through the posterior wall. We have now administered 695 consecutive intravenous injections without making a single incision through the skin.

Of course the region of the elbow is first rendered aseptic by painting it with tincture of iodine or by scrubbing it well with 95 per cent. alcohol. We now prefer the latter method, as a mild dermatitis sometimes follows the iodine even when it has been removed with a 10 per cent. ammonia solution. Sterile towels are placed around the upper arm and the forearm and hand, leaving bare only the elbow that has been cleansed. The salvarsan is prepared according to the directions with each ampoule, using *always freshly distilled or redistilled water* both for the salvarsan and the physiologic salt solution, as many observers have shown that stale distilled water greatly increases the toxicity of salvarsan and may also make physiologic salt solution toxic. Everything is boiled for 15 minutes. The bottles are rinsed with filtered, distilled water and the solutions of salvarsan and physiologic salt solution are filtered into their respective bottles. If the preparation is begun with water 110 degrees F. the solution will reach the patient at about the right temperature unless the operator is delayed at some part of the procedure.

A tourniquet is adjusted above the elbow so as to well distend the veins of the forearm. It is important to have a tourniquet that is easy to adjust and one that can be quickly released with one hand in order not to pull out the needle in the effort to remove the tourniquet. The most satisfactory one we have used is the "instantaneous," which with one or two turns around the arm gives the desired constriction; it may be easily released by pulling the round rubber cord out of the groove in the block which holds it.

The apparatus we use consists of two 500 c.c. drain bottles connected by rubber tubes to a three-way cock, into which a 20-gauge needle is screwed. A new, sharp needle with rounded edges is preferable. Bulbous glass connecting tubes are placed

about two inches from the stop-cock and plain straight connecting tubes about 12 inches from the drain bottles. Bulbous glass tubes near the stop-cock are recommended for the following reasons: they act as traps and catch bubbles of air that might by chance be in the tubes; while a little air would probably do no harm if carried into the vein, it is just as well to prevent it; especially as the inward flow of the saline mixed with blood is more clearly seen through the bulbous than the straight tube. The glass inserts near the bottles are for the purpose of disconnecting the tubes so that they may be boiled without disturbing the solution bottles when more than one treatment is given. A clamp is also placed on each tube near the bottle. By the time the next patient is prepared all contaminated parts of the apparatus have been thoroughly boiled and the solution has only to be poured through the filters into the bottles.

The patient reclines on an operating table and the arm is placed at a right angle to his body, on a small table covered with a sterile cloth. The largest vein is selected and a point over it is cocainized by injecting a few drops of cocaine into the skin, not under it; this renders the remainder of the operation practically painless. The hole is now pushed through the skin as previously described and the needle, connected to the three-way stop-cock, is inserted into the vein (Fig. 3). It is first pushed straight downward until the point is engaged in the wall of the vein, then the needle is lowered and further inserted while it is nearly parallel with the vein. This lessens the danger of going through the opposite wall of the vein.

The drain bottle containing physiologic salt solution is now lowered below the arm, and the stop-cock so adjusted as to open the vein into the tube leading to it. If the vein has been properly entered, the blood quickly flows into the bulbous glass connecting tube. The tourniquet is then removed and the bottle placed three feet above the patient's arm (Fig. 4). The *rapidity* of the inward flow of the bloody salt solution enables one to tell immediately if the needle is in the lumen of the vein. No swelling occurs at the site of the injection. If all goes well

the stop-cock is adjusted so as to allow the salvarsan solution to flow into the vein; with three feet of elevation this flows in by gravity in five or six minutes. Pain and swelling at the point of injection always indicate a faulty adjustment of the needle, and a further effort should be made until it flows perfectly.

When the proper dose has been given the stop-cock is turned so as to allow a little salt solution to flush out the needle, which is then withdrawn and the opening in the skin compressed with sterile gauze until the slight bleeding is stopped. The puncture in the skin is sealed with collodion. The patient, who has been drinking freely of lithia water for several hours previous to the operation, is instructed to continue it for a week. He is allowed to go home, advised to make the next meal a light liquid one and to remain quiet for 12 to 24 hours.

While the solutions are flowing into the veins the bottles may be placed on a small shelf, covered with a sterile towel, three feet above the patient's arm; or if preferred they may be suspended upon the ordinary irrigating stands, usually part of the operating room equipment.

DOSAGE AND REPETITION OF TREATMENT.

Salvarsan requires unusual accuracy in determining the proper dose. This can only be ascertained after a *careful physical examination;* from this, when considered with the weight and vitality of the patient, an estimate of the dose then can be made. The amount should always be smaller when there is a brain or spinal lesion. If there is *doubt* as to the ability of the patient to withstand the usual quantity of the drug, a small dose should be administered and another somewhat larger dose given within one to two weeks according to the reaction. If the improvement is satisfactory still larger doses may be given at suitable intervals until all manifestations of the disease have disappeared. It is upon the repetition of the treatment that success and freedom from neuro-recurrences will depend. If the remedy is properly administered the patient will rarely object to further treatment, as the pain will scarcely ever be as

much as that of an intramuscular injection of salicylate of mercury. If the patient is in good health and a full size dose is administered, it should be repeated in a month regardless of whether all of the evidences of disease disappear or not. If the blood test is positive at the end of another month or if there is any doubt as to the result, more of the remedy should be given and again repeated as indicated. The average dose for adults may be considered 0.1 gramme for each 30 pounds of weight. Albuminuria need not prevent salvarsan being given, provided the dose is small and a large quantity of water is taken daily for several weeks to dilute it as it is eliminated in the urine. In our patients the albuminuria has so often quickly disappeared after treatment with salvarsan that we are of the opinion that syphilis is a more frequent cause of renal affections than is generally supposed. Serious heart and lung diseases should contraindicate the use of salvarsan except in the smallest doses administered with the greatest precautions.

The dose for infants and children should be very small and repeated every two to four weeks intramuscularly until an adequate amount is given. Inunctions should also be given to supplement the salvarsan.

Mercury.—The question as to when mercury and iodide of potash should be administered is of great importance and of course, as yet, is a debatable point. In our own work when patients could report for examinations after all lesions have healed and after what we thought to have been an adequate course of salvarsan we have not administered other remedies except where it seemed indicated to assist in rendering the blood test negative or in clearing some unusually stubborn syphilitic manifestation. Believing as we do that salvarsan is a much more potent remedy in combating syphilis than is mercury and being more pleasant for the patient to take and much less dangerous than the uncured disease, we have felt that better results would follow repeated injections of salvarsan than the mixed treatment. If our patients were not cured with salvarsan then we believed they needed not less than a year or two of mercury. This of course did not seem indicated

for the majority, *therefore we did not wish to confuse ourselves by giving mercury to all and make the results of salvarsan appear better than they really were.* Mercury tends to mask symptoms and to keep the disease temporarily in abeyance, and may make the blood test temporarily negative. If the patient cannot report for examinations he should be given mercury after even what may seem an adequate course of salvarsan or neo-salvarsan. Active treatment with all three of these remedies affords the chief precautionary measure against neuro-recurrences.

Neo-salvarsan, "914."—Neo-salvarsan is the name given to a perfected preparation of salvarsan which, after 285 injections, we believe to be superior to "606." Through the courtesy of Prof. Ehrlich we have been furnished a supply of this remedy, which we have been using since April 10. It is freely soluble in water and is neutral in reaction, requiring no caustic soda as did salvarsan, nor should it be dissolved in physiologic salt solution, as sodium chloride precipitates it. It needs only to be dissolved in one-half the quantity of water required for salvarsan and is given in the same manner. Only freshly distilled water should be used in its preparation. The experience gained from 283 intravenous injections to adults and 2 intramuscular to a baby has convinced us of its superiority over salvarsan.

1. It has only to be mixed with water and then is ready for the injection.

2. Very slight disturbance of the patient is produced by its injection intravenously, nausea, vomiting, chill and fever being unusual complications, except a slight rise of temperature when the syphilitic manifestations are acute. The subsequent injections cause practically no reactions and the treatments are not objected to by the patients.

3. The mildness of the symptoms produced enables one to administer full doses with more impunity than was the case with salvarsan; therefore with larger doses, repeated at shorter intervals, we may hope for more complete cures and few, if any, neuro-recurrences.

4. The practical perfection of the technic before it is placed upon the market will probably result in more uniformly satisfactory results from neo-salvarsan than resulted from salvarsan. The patients who have received both of these preparations have expressed a decided preference for neo-salvarsan.

We have had ample evidence of the potency of neo-salvarsan, as we have seen the prompt disappearance of the *Spirochæta pallida* from chancres in which they were abundant before the injection. On account of the repetition of the doses we have thought that the lesions healed even more quickly than similar sores healed after injections of salvarsan. The skin rash has promptly disappeared, as have also the following affections: mucous patches, luetic sore throat, tertiary ulcerations of the nose, periosteal inflammations, syphilitic deafness, syphilitic rheumatism and other minor affections more or less closely related to those mentioned. Where there was no reason to the contrary the doses were given intravenously to male adults about as follows: 0.75 to 0.9 gramme of neo-salvarsan, a quantity equal to 0.5 to 0.6 gramme of salvarsan, at the first treatment; the same size dose or a larger one was administered every two or three days until three or four injections were administered. A month is then allowed to elapse and two or more treatments are recommended. Two will probably be sufficient if the blood test is negative and all signs of the disease are absent. Again at the end of the next month another dose of 0.75 to 0.9 gramme should probably be given, and the patient requested to return at intervals for examinations, and, two or three months after what seems to be an adequate course of treatment, for another Wassermann test. No mercury is as a rule recommended until later when it is found to be necessary to supplement the treatment. So far none has been required, though it is too early to say anything regarding the lasting effect. The potency of the preparation and the apparent impunity with which repeated injections may be administered lead us to be very hopeful regarding the ultimate results.

More recently we have given the injections about once a

week until about six or eight injections are administered or until all evidences of disease have disappeared.

The patients receive their injections in the afternoon and are then allowed to go home, where they are requested to remain quiet for the night and drink freely of water for a week. The next morning they have invariably been ready for their accustomed occupations, not feeling as badly as do many patients feel who have taken a dose of calomel. Occasionally the patient complains of headache the first night or the next day. For this reason the initial dose recommended in cerebral syphilis is much smaller than the usual one. A slight diarrhœa is not infrequently observed. As more experience is gained we may not feel the necessity of giving as many doses of neo-salvarsan as above outlined. Judging from salvarsan we have felt, though, that it would give better results if we repeated the doses in a month instead of resorting to mercury, which would confuse the whole situation and be more disagreeable for the patient to take. The fact that our patients, now not inconsiderable in number, have thrived upon salvarsan and neo-salvarsan as similar patients have never done before upon mercury and other remedies has convinced us that we are probably not wrong in our recommendation regarding the repetition of the injections instead of giving mercury. These observations have lasted over a period of more than 18 months, during which time we have been on the alert to make such changes in the technic and course as our results and those reported by others seemed to indicate.

AFTER-TREATMENT WHEN LESIONS ARE INDURATED.

We know of nothing so important, when lesions are indurated, as to apply heat in order to produce hyperæmia of the diseased area and thus bring the greatest possible amount of salvarsan to the point where it is most needed. Early in our work we experienced considerable difficulty at times in securing the softening of the indurated chancres. Since we began to apply heat for four to six hours daily for the first

three days after the treatments there has been quite evident hastening of the absorption of the induration. This is especially true in those where healing of the chancre has not occurred some time previously. The long-standing, apparently fibrous hardness is always slower in disappearing.

For chancres on the penis we are accustomed to advise the patient to soak it in a pitcher of water as hot as can be borne for several hours daily for three days. Hot water should be added frequently to keep up the desired temperature. Hot fomentations may be used instead if the lesions are so situated that they cannot be immersed in hot water. In some instances Bier's hyperæmic suction cups applied from time to time might be even more useful than hot applications in producing the hyperæmia. We are convinced that the patients who have followed assiduously the suggestions to bring a free supply of blood to the diseased parts have made more rapid progress than those who neglected it. When seen early, and such an operation seemed feasible, the chancres have been excised.

While we are aware that many do not fully agree with us in the plan we follow in postponing the use of mercury until needed, we believe it is based upon sound reasoning and we cannot do better than to refer to the continued good health of the patients who have followed our advice and to the fact that no ill effects, except a few early transient ones, have resulted from the medicine. Never in the practice of medicine have we been able to do so much good for patients, no matter what the disease or what the remedy, as we have done for our syphilitics with salvarsan and neo-salvarsan. Some perhaps criticise us for what may seem to them to be undue enthusiasm; in answer we would say that the results we have obtained after 860 injections of these remedies compel enthusiasm and, we feel, justify us in it. Our enthusiasm, however, has been moderated from the first with *caution—the utmost caution.*

THE PROVOCATIVE WASSERMANN AND LUETIN TESTS.

Undoubtedly blood taken 24 to 48 hours after an intravenous injection of salvarsan or neo-salvarsan greatly en-

hances the delicacy of this test and should invariably be done before declaring the patient cured or even probably cured.

We are indebted to Dr. Hideyo Noguchi, of the Rockefeller Institute, for a supply of luetin which we have utilized in a considerable number of patients during the past two months, and we believe will prove of great value in latent infections, especially if the test is made during the hypersensitive period, about 10 days after an injection of 606 or 914. A detailed report will be made later regarding the provocative Wassermann and luetin tests.

IVORY DOWEL FOR PRESERVING THE FINGER IN A CASE OF ENCHONDROMA OF A PHALANX COMPLICATED BY FRACTURE.

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ENCHONDROMA affecting the long bones of the hand and foot is common, and in certain cases it is not surprising that fracture of the bones affected should readily occur, as the compact tissue covering the tumor becomes very thin and may break spontaneously or with slight violence. The case recorded herein is that of a fracture of the proximal phalanx of the index-finger of the right hand, in which the digit was preserved by first removing the enchondroma and then inserting an ivory peg in the centre of the shaft of the bone. A case such as this is usually treated by amputation; it is therefore worth recording the following history of a patient in whom the tumor was removed and firm union of the fracture secured. The necessary disability and deformity which result from amputation may be prevented in suitable cases by employing the method herein described.

W. E. S., age twenty-eight, an accountant, was stoking the furnace in his house when with slight violence he broke the proximal phalanx of the index-finger of the right hand. He states that from early childhood he had noticed a marked enlargement of the bone, which was quite painless and did not trouble him. Through this region the fracture had taken place. On examination one found a fusiform tumor occupying the entire shaft of the phalanx, and on manipulation one could readily elicit crepitus, the movement of one fragment upon another at the seat of fracture causing a considerable amount of pain. A diagnosis of enchondroma of the phalanx was made with fracture through the tumor. An X-ray picture was taken (Fig. 1),

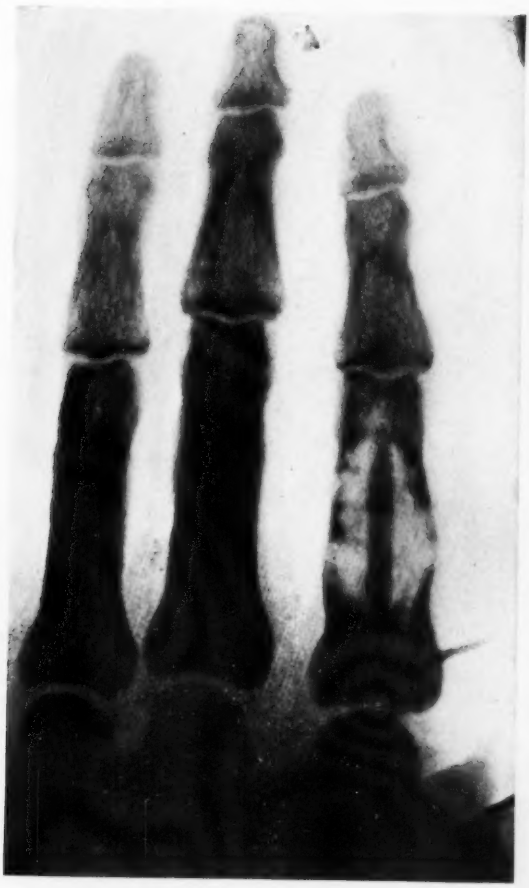
FIG. 1.

X-ray picture showing enchondroma of the proximal phalanx and a fracture through the centre of the fusiform growth.

FIG. 2.

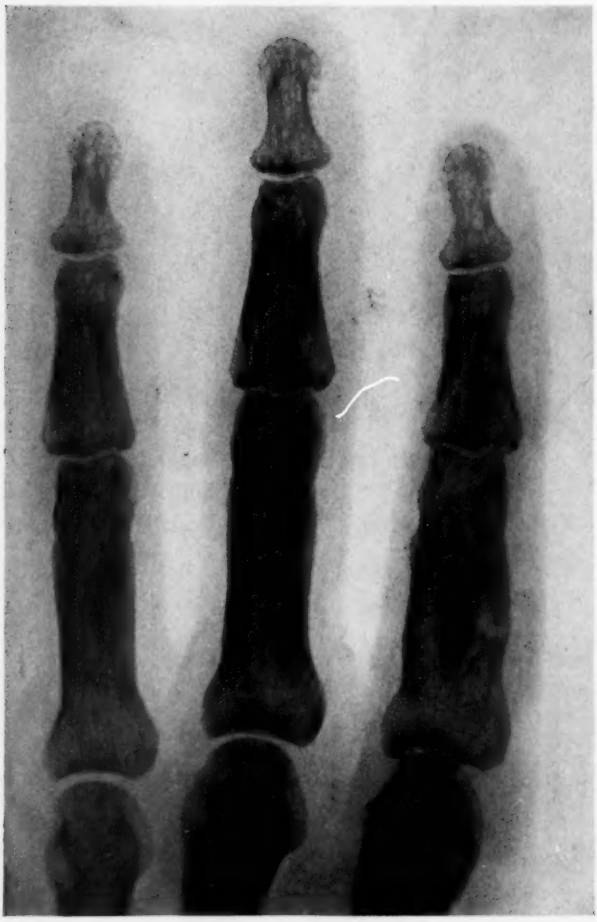
Diagram showing the slit made in the compact tissue of the distal fragment for introduction of the ivory peg.

FIG 3



X-ray taken two weeks after operation, showing an ivory peg fixed in the centre of the phalanx.

FIG. 4.



X-ray taken 14 weeks after operation, showing condensation of bone about the ivory peg and some slight degree of absorption of the peg itself.

and it showed that the fusiform tumor which occupied the centre of the shaft of the bone was covered over by an extremely thin layer of compact tissue, probably not more than a millimetre in thickness. It seemed little wonder that the bone should have broken. The patient was exceedingly anxious to save his index-finger and it was determined to make the attempt, but there seemed little prospect of getting firm union if one simply proceeded by gouging out the tumor and then applying external splints. An ivory peg was procured, 2.5 cm. long and 3 mm. thick, which was pointed at both ends. An incision was made along the radial side of the phalanx and the bone exposed at the seat of fracture. The tumor was removed by a curette, and then a longitudinal slit 4 mm. wide (Fig. 2) was made in the compact tissue of the distal fragment, by means of a Dahlgren's rongeur forceps, the ivory peg was inserted and firmly secured in the centre of the shaft of the bone, each sharp end being embedded in the cancellous tissue toward the articular extremities of the phalanx. The wound was then closed and a splint of plaster of Paris applied. Healing took place *per primam*. Firm union of the fracture followed, and subsequently the patient was able to use the finger in his work as accountant, a matter of no small importance to him. The functional result as to movement and utility was perfect and it was difficult to detect any abnormality at the seat of former trouble. The first X-ray picture (Fig. 1) reproduced herewith shows the condition at the time of operation; the second skiagram (Fig. 3) was taken two weeks subsequently, and the third (Fig. 4) fourteen weeks from the time of the break.

The tumor removed from the bone was subsequently examined, its histological structure was that of a typical enchondroma; no giant-cells were found. It belonged to the category of "central enchondroma," which according to Virchow developed from germinal cartilaginous tissue which had been displaced from the epiphyseal zone into the bone marrow of the diaphysis. Rickets seems to play a rôle in the development of some of these tumors, and Von Recklinghausen has attributed the disturbance in bone formation which gives rise to such growths to imperfect development of the blood-vessels with faulty nutrition as the result of imperfect vascular supply. Koch[1] believed that cysts which

[1] Koch: Arch. f. klin. Chir., 1902, Bd. lxviii, Hft. 4.

occur from time to time in long bones frequently have their origin in an enchondroma, but Bloodgood [2] looks upon this as a rare etiological factor in such conditions. The X-ray picture in my patient might well suggest a bone cyst, but no such cystic formation was found.

The treatment of the bone after removal of the enchondroma naturally resolved itself into some attempt to restore the defect in the bone caused by the excavation of the growth, and to bring about repair of the fracture. From time to time various foreign substances have been introduced into bone cavities, such as decalcified bone chips, sterile catgut, blood-clot, normal saline solution, and the filling of Mosetig-Moorhof consisting of iodoform, spermaceti, and sesame oil. Beck's bismuth paste has also been used for such purposes. More recently the transplantation of bone from one part of the body to another has found favor, and for this purpose a piece of rib or a portion of the fibula has been utilized. A remarkable series of cases have lately been reported by Küttner,[3] where he succeeded in transplanting large portions of bone (*e.g.*, the upper third of the femur) from the body of an individual recently dead to replace a similar portion of bone removed from a patient for tumor growth.

In the case recorded herewith ivory was used and proved quite suitable. The last X-ray picture taken 14 weeks after the operation shows a remarkable degree of condensation of the bone about the ivory peg, and in the same picture it will be observed that some slight degree of absorption of the piece of ivory has taken place. The advantage which may be claimed for ivory is that it is readily obtained and thorough asepsis can be secured in its introduction. Moreover where splinting is required, this may be attained as in my case by utilizing the piece of ivory for the purpose.

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[2] Bloodgood: Trans. Am. Surg. Assoc., 1910, vol. xxviii, p. 154.
[3] Küttner: Beit. z. klin. Chir., 1911, Bd. lxxv, Hft. 1 and 2, p. 1.

THE REDUCTION OF THE FRAGMENTS IN FRACTURES OF THE LONG BONES.

TWO METHODS AVAILABLE PREVIOUS TO PLATING.

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THE reduction of fractures of the long bones, especially fractures of the femur and tibia, may be accomplished by one of two methods—either traction or distention.

Chief among traction methods are Buck's extension, Bardenheuer's complicated system of springs, the Steinmann nail

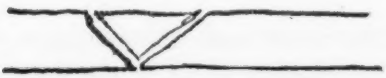
FIG. 1.

Partially reduced double oblique fracture.

method, and, lastly, the Lemon-Mueller apparatus of recent date. Each of these methods has its especial usefulness under certain circumstances. Distention or pushing apart of fragments also has its own indications.

In the majority of recent fractures of healthy bone, re-

FIG. 2.



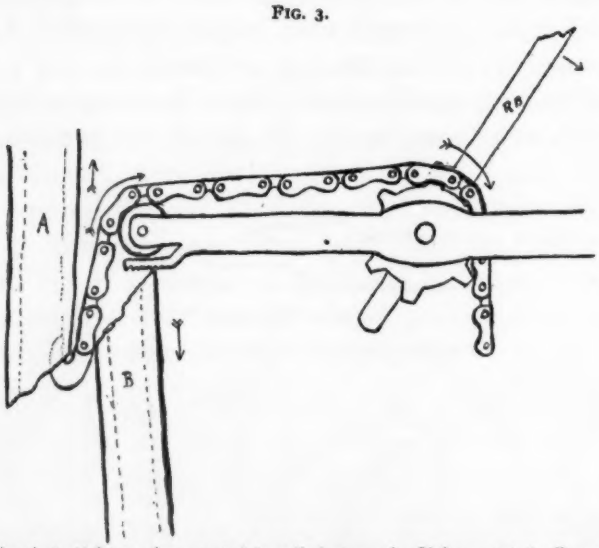
Completely reduced double oblique fracture.

duction by operative interference is not necessary. Where, however, an operation is required, as in the case of separation of the fragments by soft parts, reduction may be obtained either by the rather cumbersome extension methods of Lemon-Mueller, Steinmann, Martin, etc., or by one of the two methods which are described below, one of which is a

combination of traction and distention, and the other distention alone.

In certain older fractures the bones are often porous because of long disuse (so-called rarefying osteitis). Here the cortical substance of the shaft may be as easily whittled as soft wood, hence screws do not hold and plating is out of the question. In addition, the soft parts are so contracted that complete reduction is impracticable, even after a most extensive freeing of all callous and tendinous attachments from

FIG. 3.



As the chain tightens, fragment *A* is pulled upward. If fragment *A* offers resistance, then fragment *B* is pushed downward. A pull of 150 lbs. on the removable rod (*R B*) exerts over 1000 lbs. pull on the chain; the power available is greatly in excess of the amount required.

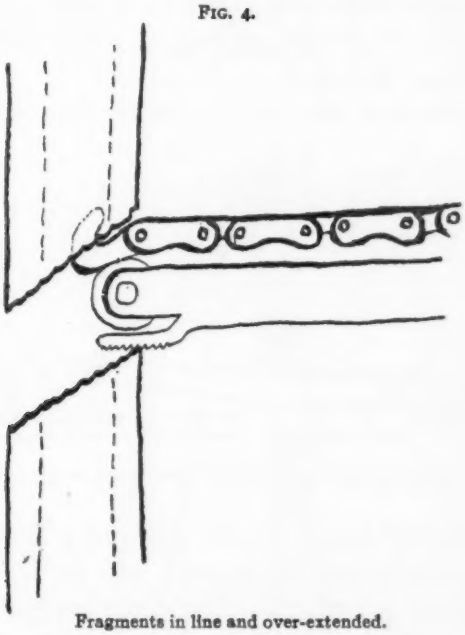
the fragments, for under such circumstances complete reduction could only be brought about by the use of so much force that there would be danger of rupturing nerves and blood-vessels. Under these circumstances traction is the only method available, Steinmann's method of extension by nails being the most effective. Further, where soft bone and much contraction of soft parts are found at operation, a certain amount of bone must be removed from the ends of both fragments in order to bring them in line (end-to-end). Fixation of the

fragments may be accomplished by an intramedullary bony splint, or by suturing the ends with heavy chromic gut or wire, or by a combination of both these methods.

Let us now return to the more promising field of operative reduction of fractures in which the bone is still healthy. If the fracture be transverse, the limb is kinked, the ends of the fragments are probably coapted, and the limb is then straightened out. The fragments stay in place.

If the fracture be oblique, greater difficulties are present,

FIG. 4.



Fragments in line and over-extended.

for the oblique surfaces slide past each other and the method just described is of no use. Here traction or distention must be used to accomplish reduction, and must be maintained until the fragments are fixed by a suitable clamp or plate.

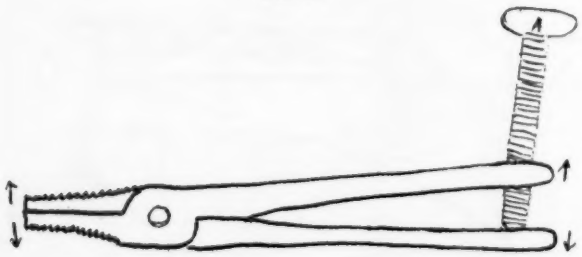
If the fracture be of the double oblique type (Fig. 1), still greater difficulties of reduction present themselves. The two main fragments when reduced meet at what is practically a point (Fig. 2). Maintenance of such a position (until the plate or clamp has been applied) is very difficult.

In reducing a fracture it is relatively easy to bring down the overlapping to within from one-half inch to one inch of complete reduction. The nearer the complete reposition of fragments is approached the greater is the resistance of reduction. In other words, it is the overcoming of this last inch or less of shortening which affords the greatest difficulty.

The obstacles encountered in operating on two fractures of the femur at the City Hospital (Blackwell's Island) in August, 1911, suggested to me that a simple effective method for reduction of fragments might be evolved which could be applied directly in the wound itself. Two different methods of technic were developed.

The *first method* is as follows: After the ends of the frag-

FIG. 5.

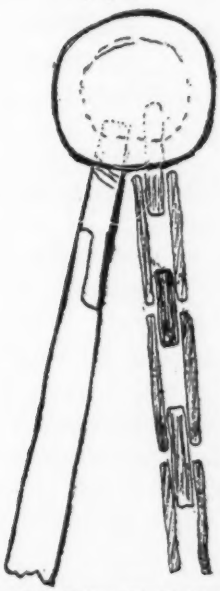


Stretcher. As thumb-screw (*A*) is turned, the jaws open and spread apart.

ments are exposed and freed, the point of a hook on the end of a small bicycle chain is inserted into the medulla of one fragment (Figs. 3 and 7). The chain leads over an idler wheel at the end of a steel bar which rests on the tip of the other fragment. Fully six inches from the end of the bar is a sprocket wheel, the teeth of which engage openings in the chain. The sprocket wheel is centred on a thick axle which is pierced by two holes at right angles to one another. Removable rods (*R B*) can be inserted into these holes; when pulled upon, they cause the sprocket wheel to revolve. The arrows in the diagram illustrate the lines of force present—as the chain tightens, it tends to pull fragment *A* upward, and if this fragment offers resistance, the tendency is for

fragment *B* to be pushed downward. A continuation of this process will result not only in sufficient extension, but also in bringing the two fragments into proper alignment (Fig. 4). There is about three-quarter-inch over-extension. A stretcher (Figs. 5 and 7) is now inserted radially (Fig. 6) to centre of bone and close to end of bar. A little further extension by the stretcher frees the end of the bar. The chain is then slackened, and, first, the bar is moved, then the hook and

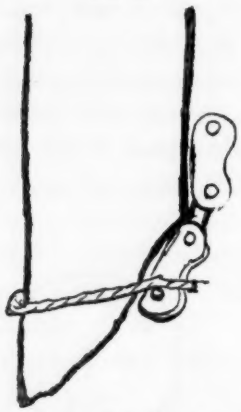
FIG. 6.



Spreader inserted (radially) alongside the hook and chain tractor.

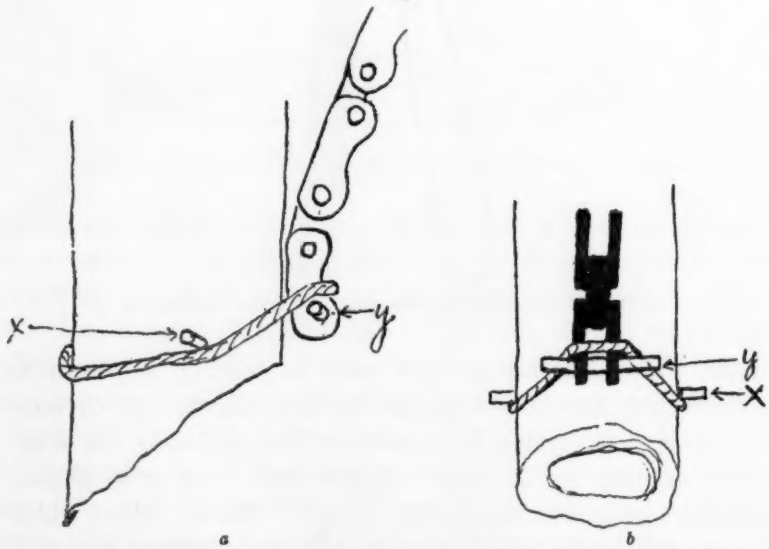
chain. The stretcher is now made to contract as much as possible. A Lowman bone holder is applied so as to seize both fragments and a Lane plate. This prevents the fragments slipping out of place. A periosteal elevator or similar suitable instrument is inserted alongside the stretcher, which is then removed. The periosteal elevator prevents any slipping of the fragments past one another on removal of the stretcher. The Lowman bone holder is tightened still more, and the periosteal elevator is finally removed. The frag-

FIG. 8.



Method for attaching the chain to the end of the bone by means of one steel pin and a loop of wire. The method is only applicable to oblique fractures.

FIG. 9.



Side and front view of method for attaching chain to end of bone by means of two steel pins and a loop of wire. One pin (x) lies in a transversely drilled hole in the bone and the other pin (y) lies in the open holes in the last link of the chain. This method is applicable to fragments of any shape.

ments and Lane plate are now held in their proper position ready for the application of splints. It is well to emphasize that *both fragments and tractor must be constantly maintained in the same plane, and the straight bar of the tractor must always be at right angles to the bone against which it lies* (see Fig. 3).

The method just described was successfully used by Dr. William H. Bishop of New York on January 21, 1912, upon a boy of twelve who had fractured his femur 14 days before operation. Extension and immobilization had done no good—there was three inches shortening. Within three minutes after application of the hook and chain instrument, it was possible to insert the stretcher and to remove the traction appliance. A Lane plate was applied without further trouble. Convalescence was uneventful, and now, four months after operation (May, 1912), the boy is reported perfectly well.

In another case (Dr. A. A. Berg) a woman of sixty-five had a non-union of the femur three months after fracture, with from 2½ to 3 inches shortening. At operation, October 16, 1911, the rarefied ends of bone did not withstand pressure of the hook, which tore out, making a gap in the bone very much like that from a cranial rongeur. Other methods of traction were employed without success. It was deemed wiser to resect the ends of the bones and then plate rather than to risk causing serious damage from undue force. The patient made a smooth, uneventful recovery.

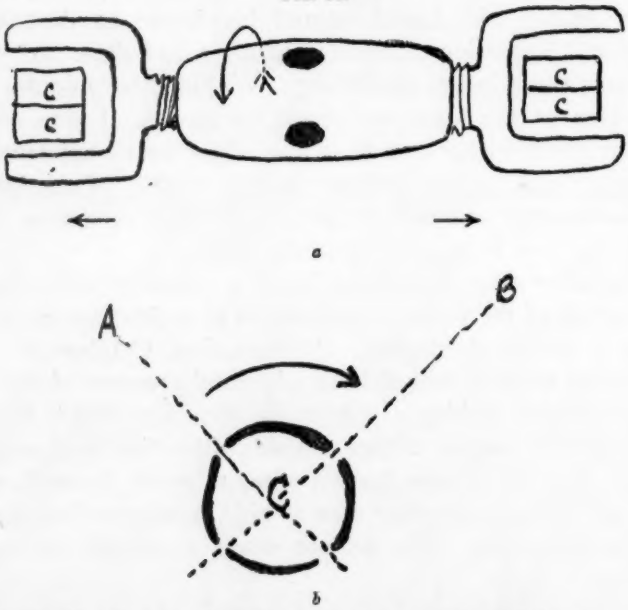
The traction method just described is effective in recent oblique fractures. Its weak point is the mode of fastening the chain to the bone. Instead of a hook, a strong loop of wire with steel pins may be used (Figs. 8, 9*a*, and 9*b*). Canvas or metal cups possess the disadvantage of being troublesome to remove from between the fragments after extension has been accomplished. Dr. M. M. Sweeney, of the Bellevue Hospital interne staff, has suggested that the hook be fastened to the chain by a swivel. This modification has not been afforded a trial as yet.

A *second reduction method* is far simpler. This method

was suggested by seeing a case of double oblique fracture (Fig. 1) in which the tractor (hook and chain) naturally was of no use.

After proper exposure and freeing, a Lowman clamp (Fig. 13) is applied to each fragment. A turnbuckle (Figs. 10*a*, 10*b*, and 13) is so inserted that the jaws at its ends engage the shafts of the clamps on either fragment (Fig. 11).

FIG. 10.

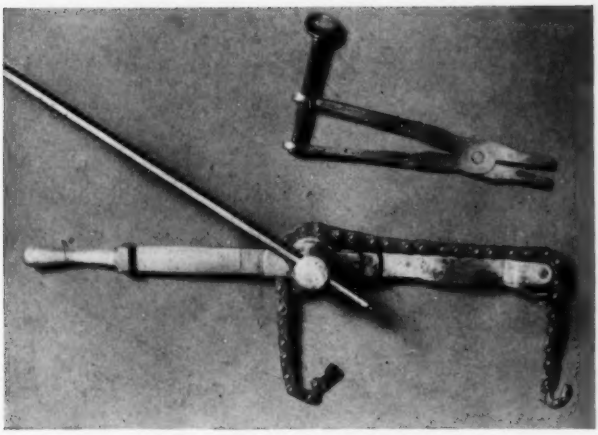


a, turnbuckle. Jaws seen from above; they are purposely made large enough to fit the shafts of the Lowman clamps (*c c*) loosely, thus facilitating easy adjustment (alignment) of fragments. *b*, cross section of barrel of turnbuckle. One-quarter turn (by inserting pin into the hole and rotating) exposes the next hole. The right angle (*A*, *C*, *B*) defines the approximate amount of room afforded by the average wound.

As the barrel of the turnbuckle is rotated, the clamps (fragments) are forced apart. When the turnbuckle has reached its maximum extension, a second longer turnbuckle (Fig. 13) is applied and continues the extension as far as necessary.

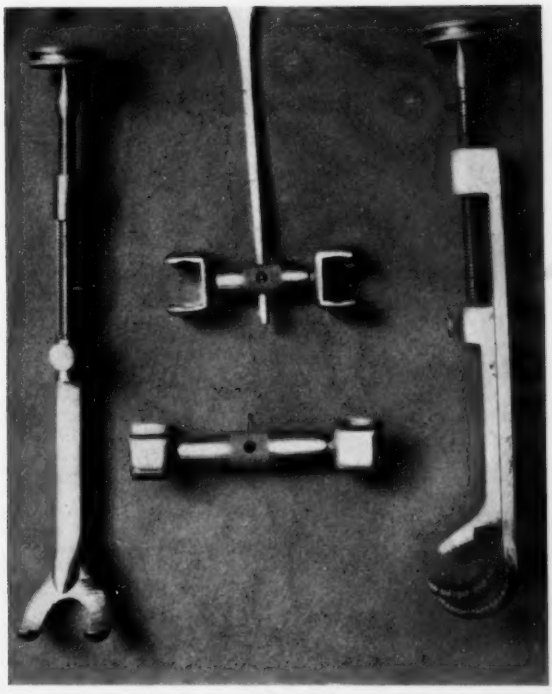
The turnbuckle's jaws are made to loosely fit the shafts of the Lowman clamps in order to permit of the fragments (which are out of line) being gradually brought into their proper relation.

FIG. 7.



Tractor with one rod in place, below; spreader half open, above.

FIG. 13.

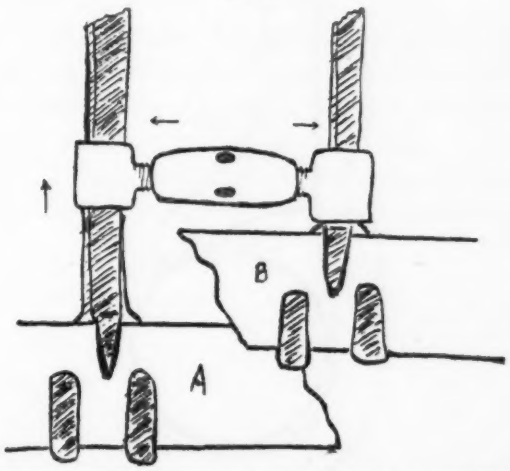


Anterior and lateral view of modified Lowman clamps. Smaller turnbuckle with key in place. Range of smaller turnbuckle is from 1⅞ to 2½ inches; range of larger turnbuckle is from 2⅜ to 3½ inches.

The following details of application must be kept in mind:

1. After both clamps are applied to the bone, and the turnbuckle is in place between them, one clamp should be loosened, but should be maintained in proper relation to the turnbuckle. Now the limb should be pulled upon, and when the maximum extension has been made, the clamp should be tightened and *extension is continued by means of the turnbuckle.* At times lateral pressure may be necessary to keep the fragments in line during extension.

FIG. 11.



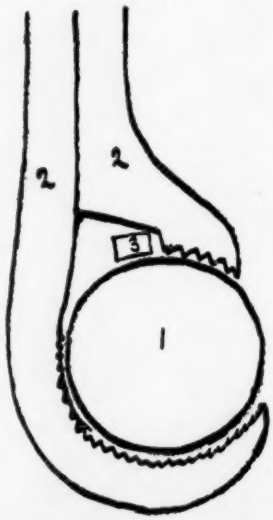
After sufficient extension has been made, the shaft of the clamp holding fragment *A* can be pulled upward (sliding in the jaw of the turnbuckle, see arrow) so that the two fragments come into proper alignment. Just previous to alignment, a Lane plate can be slipped under the clamp on fragment *B*. After alignment the plate is also slipped under the clamp on fragment *A*.

2. By applying the Lowman clamp so that the angular gap between it and the bone comes uppermost (Figs. 12 and 13), a Lane plate can be slipped along the bone without loosening the clamp or disturbing the turnbuckle. The plate may be placed beneath one clamp at any time before the fragments come in line. When proper alignment has been made, the plate is slipped through the gap in the clamp on the other fragment and can then be firmly held in place by small wedges if desired.

3. The Lowman clamps should be so applied that both their shafts lie to the same side of the bone, so as to facilitate proper alignment and to prevent turnbuckle and clamps from interfering with the drilling of holes for screws, etc.

4. In a double oblique fracture (Figs. 1 and 2) if the Lowman clamps be applied so that they partly overlap the oblique fractured surfaces of the main fragments, it will be possible, after slight hyperextension, to loosely place the third triangular fragment into position, and then, by gradually al-

FIG. 12.



This diagram illustrates heavier construction and slight modification of the Lowman bone holder (*2, 2*) to permit convenient adjustment of the Lane plate (*3*) without disturbing the holder's grip upon the bone (*1*).

lowing the main fragments to approach each other, the third fragment exactly occupies its proper location. The turnbuckle may even now be removed, previous to plating.

The turnbuckle and clamp method was first employed on a case of Dr. Howard Lilienthal's at Bellevue Hospital on April 4, 1912. A man of 27 had fractured his femur 15 days before operation. All efforts at reduction had failed—there was complete separation of fragments (no crepitus was obtainable);

shortening was from ½ to 2½ inches. The tractor (Fig. 3) was first tried a number of times, but the bone did not withstand the local pressure of the hook, which repeatedly tore out. The turnbuckle and clamp method was then employed with success.

The turnbuckle and clamp method is applicable to any type of fracture in which the bone itself is sound. The method is simple, effective, and inexpensive. There is one danger attending its use, namely, the employment of too much power, with the possible rupture of important structures. This is most apt to occur in cases of very long standing; that is to say, of a number of months' duration.

A consideration of the factors preventing adequate extension and a means of relieving a considerable part of the strain during extension has been brought out in a previous paper in ANNALS OF SURGERY, October, 1912, p. 642.

In closing, I desire to express my gratitude to Drs. Bishop, Berg, and Lilienthal for giving my instruments a trial.

TYING THE KNOTS OF LIGATURES AND SUTURES WITH ONE HAND.

BY GEORGE H. MONKS, M.D.,
OF BOSTON, MASS.,
Surgeon, Boston City Hospital.

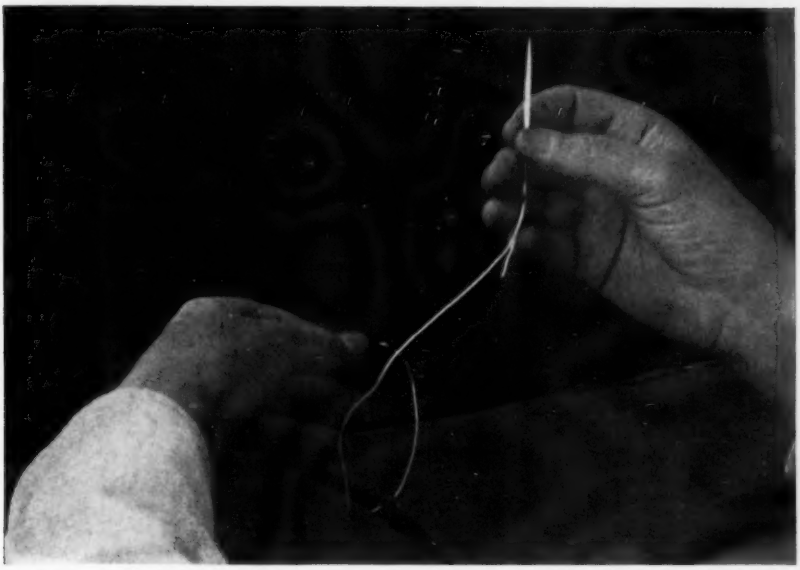
It seems to me that it is very desirable for the surgeon not to confine himself to any one method in tying the knots of ligatures and sutures. If he has a number of different methods he will naturally choose for each knot that method which at the instant of tying is the most convenient and rapid.

For this reason I wish to describe a method of tying the knot with one hand. This method I devised about 20 years ago, and since then I have often found it useful as a time-saving expedient, especially in operations where much tying was to be done. As a number of surgeons have learned to tie this knot and have used it a good deal in their work, it occurs to me that perhaps it may be useful to others.

I am quite aware that the suggestion of tying knots with one hand is not a new one; in fact I am sure that at least one such method has already been published, and I know of still one other which I believe has never been described in print. I have no doubt that there are a number of different methods by which a knot may be rapidly tied with one hand, but, as I have no experience with other methods, I shall confine my remarks to the technic of the method I do know and have used. When once the different steps of this method have been learned, the knot can be tied with great rapidity and ease.

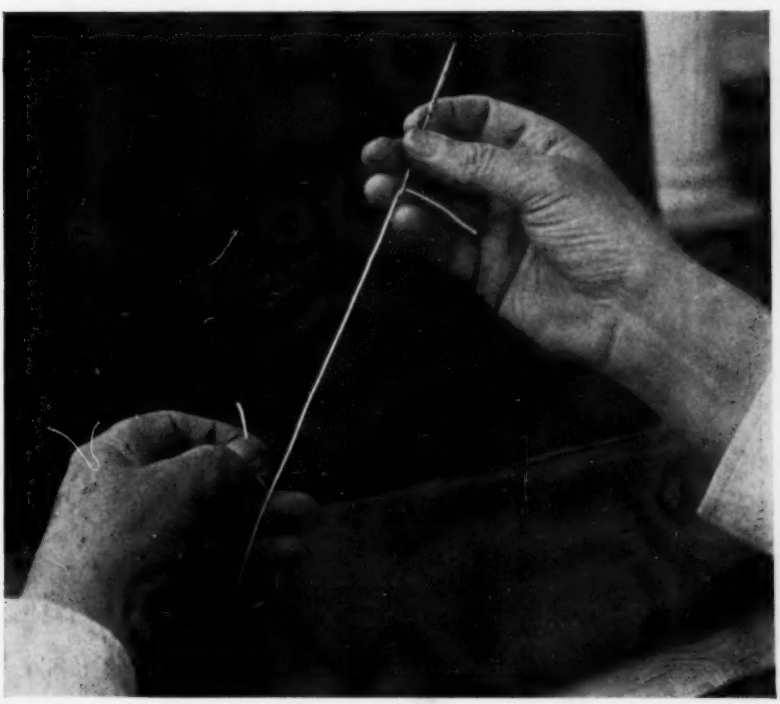
In the regular process of tying a knot in a surgical operation one end is twisted completely around the other, making a "half hitch" so-called. This is tightened by drawing the two ends apart, and another half hitch is then made on top of the first one. If these two half hitches are made in the same way, the knot is a "granny knot." If the second half hitch is the reverse of the first one, then a "square knot" re-

FIG. 1.



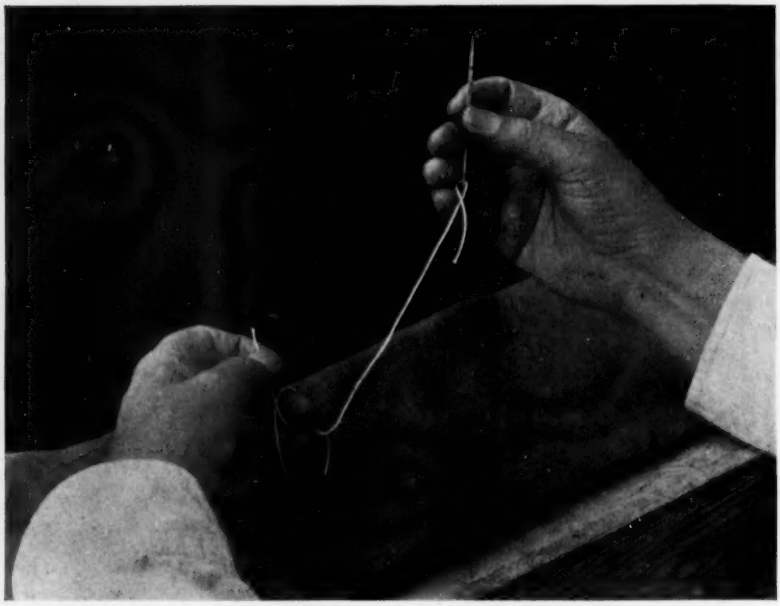
The suture has been drawn through the two lips of the wound. The right hand holds the needle, and the left hand is reaching for the distal end of the suture.

FIG. 2.



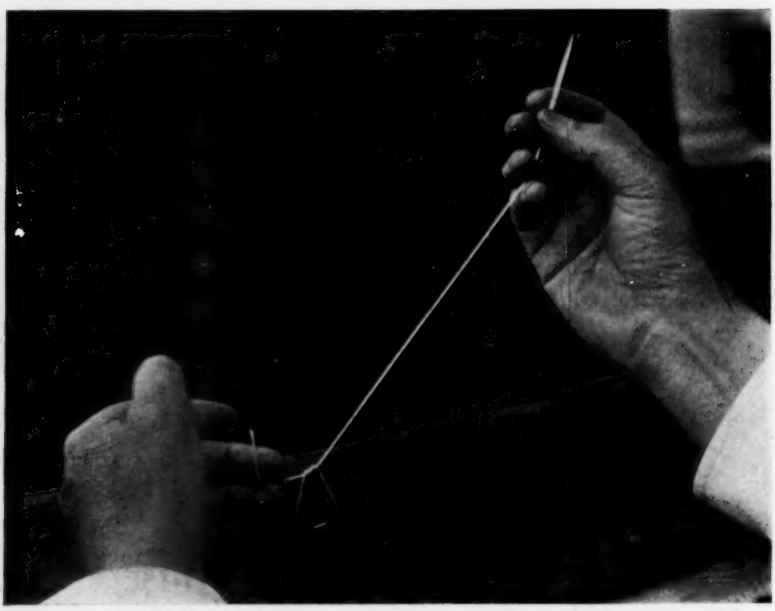
The distal end of the suture having been seized between the thumb and finger of the eft hand, and the middle and ring fingers having been extended in front of it, the proximal part of the suture has been carried back so as to cross its distal part above these fingers.

FIG. 3.



The middle finger having been strongly flexed, carrying with it on its palmar surface the proximal part of the suture, and at the same time the distal end of the suture having been drawn by the thumb and forefinger around the tip of the middle finger, this part of the suture is deposited in the space between the middle and ring fingers, and is held firmly there.

FIG. 4.



The distal end of the suture having been released between the thumb and forefinger, is drawn by means of the middle and ring fingers through the loop which surrounds these fingers.

sults. Figs. 1, 2, 3, 4, and 5 show the various steps of the one-handed knot in making the first half hitch; and the other figures illustrate the process of making the second half in such manner as to make a square knot.

Surgical traditions apparently do not tolerate even the idea of "granny knot," and yet we all know that such a knot is frequently tied with perfectly good results, especially where three half hitches instead of two are used. The one-handed knot may be tied so as to make either a granny or a square knot. Out of deference, however, to the opinion of those who believe that every knot should be a square one I shall describe only the process of tying a *square knot*.

For purposes of description we will consider that the suture (already inserted, as shown in the first illustration, but not tied) has two parts: a proximal (or needle) part, and a distal (or end) part.

Hold the needle in the right hand, one finger pressing on the needle's eye, so as to prevent the proximal part of the suture from slipping through it.

With the left hand reach for the distal end of the suture on the farther side of the proximal part (Fig. 1).

Seize the distal end of the suture between the thumb and forefinger.

Extend in front of it the middle and ring fingers.

Carry the proximal part of the suture back so as to cross the distal part at a point above these fingers (Fig. 2).

Flex the middle finger strongly, carrying with it on its palmar surface the proximal part of the suture.

At the same time draw, by thumb and forefinger, the distal end of the suture around the tip of the middle finger, and deposit this end between the middle and ring fingers.

Hold this part of the suture firmly between these two fingers (Fig. 3).

Release the distal end of the suture, which is held between the thumb and forefinger.

Draw, by means of the middle and ring fingers, the distal part of the suture through the loop which surrounds these fingers (Fig. 4).

Seize, between the thumb and forefinger, the distal end of the suture.

Place the middle and ring fingers so that their palmar surfaces are pressed against the adjacent distal part of the suture.

Tighten the first half of the knot (Fig. 5).

Turn the two fingers so that their palmar surfaces look upward, and their backs rest upon the half hitch already tied.

Cross the two parts of the suture over these fingers. (During this process the first half of the knot may still be held tight by keeping the two fingers somewhat apart, or by the use of smooth forceps in the hands of an assistant.) (Fig. 6.)

Strongly flex the middle finger, and insert its tip between the proximal and distal parts of the suture.

Extend the middle finger, carrying with it the distal part of the suture, and bringing it into the interval between the middle and ring fingers, so that it is held between these two fingers (Fig. 7).

Release the distal end of the suture from between the thumb and forefinger.

Draw the end of the suture (by the middle and ring fingers) through the loop which surrounds these fingers (Fig. 8).

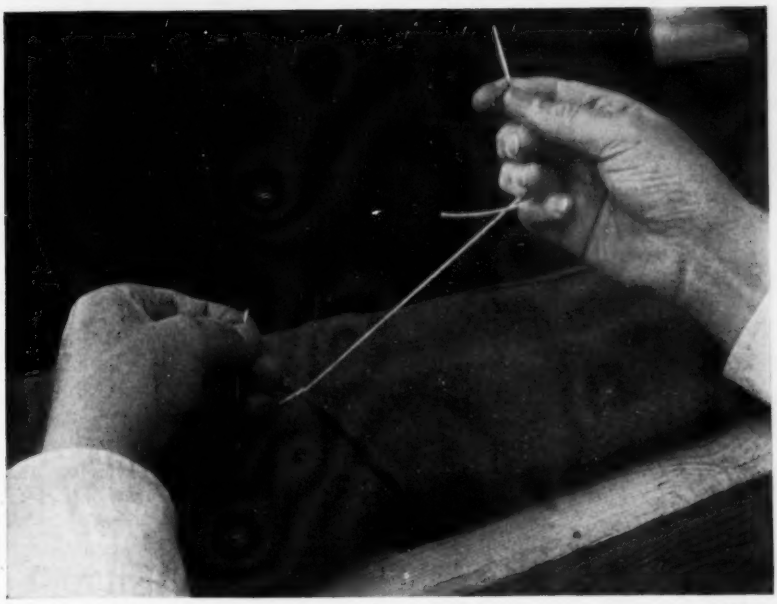
Seize the distal end of the suture between the thumb and forefinger.

Draw the hands still farther apart, thus tightening the knot; and the square knot is complete (Fig. 9).

This knot can equally well be tied when the needle has been passed through the lips of the wound in a direction away from the operator (instead of more or less toward him, as shown in the illustrations). After a little practice one can still further simplify the tying process by using only one finger—the middle one—to twist the end part of the suture round its proximal part, after which it is easily caught between the middle and ring fingers.

Although both hands are used in holding the thread, it is the left hand only which ties the knot. Some of my associates at the Boston City Hospital prefer to hold the needle with the left hand and tie the knot with the right, which, of course, is only a reversal of the process here described.

FIG. 5.



The distal end of the suture having been seized by the thumb and forefinger, the first half of the knot is tightened by the middle and ring fingers.

FIG. 6.

The middle and ring fingers having been turned so that their backs rest upon the half-hitch already tied, the two parts of the suture are made to cross over these fingers.

FIG. 7.

The middle finger having been strongly flexed, and its tip inserted between the two parts of the suture just above it, the distal part of the suture is seized between this finger and the ring finger.

FIG. 8.

The distal end of the suture having been released from between the thumb and forefinger, this end of the suture is drawn by the middle and ring fingers through the loop which surrounds these fingers.

FIG. 9.

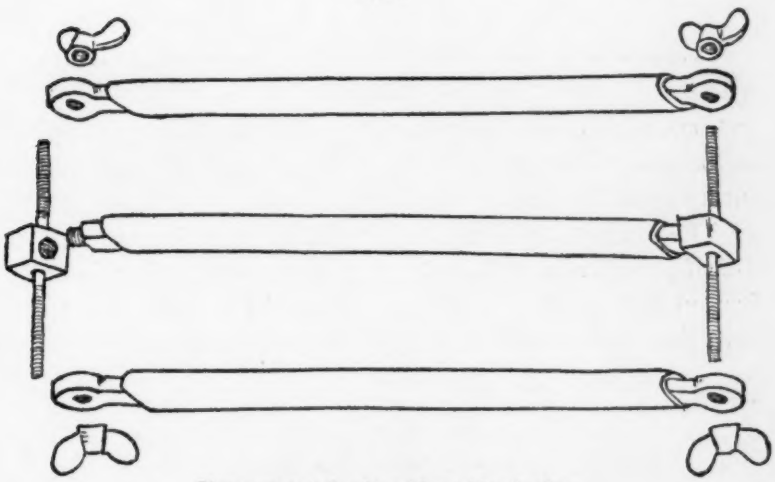
The distal end of the suture is seized between the thumb and forefinger, and the knot is tightened by drawing the hands farther apart.

A MODIFICATION OF BARTLETT'S GASTRO-ENTEROSTOMY CLAMP.

BY J. J. BUCHANAN, M.D.,
OF PITTSBURGH, PA.,
Surgeon to Mercy and Columbia Hospitals.

THE writer has had great satisfaction in the use of Dr. Willard Bartlett's clamp for gastro-enterostomy,* believing it much safer than the clamps with spring blades and ratchet handles hitherto in use.

FIG. 1.



Clamp separated, with rubber tubing in place.

After Dr. Bartlett's clamp is in place, it acts perfectly, but it is difficult to adjust the folds of stomach and jejunum at the same time and keep both folds exactly in place till the thumb-screws are tightened.

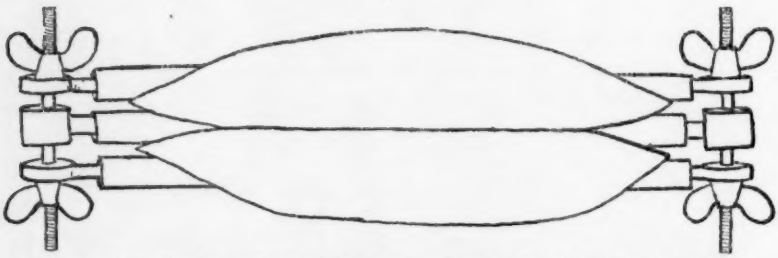
The clamp figured herewith obviates this difficulty by fixing the centre bar and having a separate pair of thumb-screws for each viscus. This allows the fold of stomach to be

* Published in ANNALS OF SURGERY, 1911, liv, 174.

fixed in place first between the fixed centre bar and one of the movable side bars. It thereafter requires no attention while the intestine is being fixed between the centre bar and the other movable side bar.

To render it possible to slip the rubber tubing over the middle bar and to facilitate removal, the latter is made in two

FIG. 2.



Clamp adjusted and closed, with folds of stomach and of bowel enclosed and held side by side, ready for the suture.

sections, which are screwed together after the tubing is applied, and require to be separated for removal of the clamp after the anastomosis has been made.

The perfect rigidity, exact parallelism, and accurate control of pressure in Dr. Bartlett's clamp as well as in this modification will no doubt commend themselves to others as they have done to the writer.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, Held at the New York Academy of Medicine, May 8, 1912.

The President, Dr. Charles L. Gibson, in the Chair.

HIP-JOINT AMPUTATION FOR SARCOMA OF THE FEMUR.

Dr. William B. Coley presented a man, 27 years old, with a good family history, who about six months ago received an injury to the upper part of the left femur. Between two and three weeks later he began to have pain in this region, but he noticed no enlargement until January, 1912, when he observed a fusiform swelling in the upper part of the femur. This rapidly increased in size, and was accompanied by marked deterioration in his general health. Dr. Coley first saw the patient on March 26, 1912, when he was referred to him by Dr. William L. Bradley of this city. He had at that time been confined to his bed for over two weeks, suffering from severe pain.

Physical examination showed a man markedly emaciated and cachectic. Examination of the left femur disclosed a fusiform enlargement occupying the entire upper half of the thigh, its largest circumference measuring 22 inches. The tumor extended well beyond Poupart's ligament anteriorly, and posteriorly above the trochanter. The hip joint was apparently not involved, and there were no palpable glands in the groin. The skin was not adherent, but was of a purplish color, due to a large number of dilated veins. There were no evidences of internal metastases.

The patient was referred to the General Memorial Hospital, and in spite of the extent of the disease, Dr. Coley thought it worth while to attempt an amputation at the hip joint, which was done on the following day. Wyeth's pins were used, but the growth extended so high up that after the leg was removed, the muscular tissues retracted underneath. An incision was made

over Scarpa's triangle, and after tying the artery and vein the skin was dissected back above Poupart's ligament and above the trochanter behind. Although there was very little loss of blood, the patient's general condition was extremely bad, and when the operation was completed he was practically pulseless. He was given four ounces of black coffee and whiskey per rectum, and upon reaching the ward, 1000 c.c. of salt solution was introduced intravenously. He rallied shortly afterwards, and was in good condition on the following morning, after which his recovery was uninterrupted. Two weeks after the operation he was put upon the mixed toxins of erysipelas and bacillus prodigiosus, which Dr. Coley said he intended to continue, with occasional intervals of rest, for at least six months, with the hope of preventing a recurrence.

Dr. James Ewing, to whom a specimen was submitted for pathological examination, reported that it was a myxochondrosarcoma. The cartilage was almost completely degenerated into mucous tissue, and there was some well-defined embryonal cartilage.

Dr. Coley also presented a man, 49 years old, whose family history was negative and who gave no history of injury. In July, 1910, he first noticed a swelling at the junction of the middle and upper thirds of the left thigh. The tumor grew rapidly, and three months later it was removed at the Jewish Hospital in Brooklyn, and immediately afterwards the toxins were given at the hospital as a prophylactic measure, and continued for a few weeks. The disease promptly recurred, and a second operation was done in June, a third in August and a fourth in December, 1911. The tumor was apparently becoming more malignant with each succeeding operation.

The patient was admitted to Dr. Coley's service at the General Memorial Hospital in March, 1912, and the toxins were again given for three weeks. As no improvement was noticed, he decided to amputate at the hip joint. The tumor was of enormous size, involving the entire middle and upper thirds of the thigh, and extending upwards from the popliteal space. It was impossible to use Wyeth's pins with the same degree of efficiency as in the ordinary case, on account of the high extension of the tumor, but as the main vessels had been secured at the beginning of the operation, there was very little loss of blood. Some of the tumor tissue was probably left behind, and Dr. Coley said he did not believe that amputation alone would offer any great hope of a

cure. There was very little shock following the operation, and the patient made a satisfactory recovery. Two weeks after the operation he was put upon the mixed toxins, which were to be continued for at least six months. At present, the patient showed no evidence of a recurrence, and he was steadily gaining in weight.

Microscopically, the growth proved to be a myxochondrosarcoma. Neither of these cases offered any hope from amputation alone. Dr. Coley states that he had performed ten amputations at the hip joint for sarcoma without mortality, seven for sarcoma of the femur and three for sarcoma of the soft parts. Of the femur cases five patients died within three to eighteen months after operation, one was lost sight of and the seventh was the patient first presented. Of the three amputated for sarcoma of the soft parts, one died soon after operation, one in which the toxins were used for three months was alive over ten years, and the third was the patient first presented. The value of the toxins in such cases is best shown by the third patient presented.

ROUND-CELLED PERIOSTEAL SARCOMA INVOLVING TWO-THIRDS OF THE SHAFT OF THE FEMUR, WITH EXTENSIVE METASTASES IN THE PECTORAL AND ILIOLUMBAR REGIONS; RECOVERY UNDER TREATMENT WITH THE MIXED TOXINS OF ERYSIPELAS AND BACILLUS PRODIGIOSUS; NO RECURRENCE AFTER NINE AND ONE-HALF YEARS.

Dr. Coley presented a boy, nineteen years old, who first noticed a swelling in the lower portion of the left femur in November, 1901. This gradually increased in size, and was accompanied by a loss of weight and deterioration of his general health. When Dr. Coley first saw the patient, on February 5, 1902, there was a large, fusiform swelling occupying the lower two-thirds of the femur. An exploratory incision was made, and typical sarcomatous tissue removed with the curette. This was submitted to Dr. E. K. Dunham of Bellevue Hospital, and Dr. B. H. Buxton, Professor of Experimental Pathology at Cornell University, and pronounced round-celled sarcoma. Amputation at the hip-joint was advised, but was refused by the patient and his family. At that time, the X-rays were just beginning to be used for malignant growths at the General Memorial Hospital, and the patient received the treatment during the spring and summer of 1902. This resulted in a diminution of

about one inch in the size of the tumor, but in the following December metastases developed in the left pectoral region and shortly afterwards in the right iliolumbar region, and the patient lost twelve pounds in weight.

An examination on January 21, 1903, showed a metastatic tumor, three inches in diameter, in the left pectoral region, apparently situated under the pectoral muscles. There was also a deep-seated mass in the lower dorsal and upper lumbar regions. These masses, which were undoubtedly metastatic, rapidly increased in size. The one in the pectoral region was removed under ether anæsthesia on February 4, 1903, and proved to be a typical round-celled sarcoma on microscopic examination. The patient was again put upon the treatment with the mixed toxins of erysipelas and *Bacillus prodigiosus,* but with practically no hope of obtaining more than temporary improvement. Within four weeks' time the tumor in the iliolumbar region began to soften and break down, and as soon as fluctuation became well marked, Dr. Coley made an incision over the upper portion of the dorsal surface of the ilium, and evacuated almost a quart of necrotic tumor tissue. A large tube was kept in place, and the sinus drained for almost a year. No X-ray treatment was applied to the iliolumbar tumor. Examination of the specimens removed from the sinus and femur at several curettings showed no evidence of sarcoma. The patient had remained in good general health up to the present time, although a small sinus in the leg had persisted, which was undoubtedly due to an extensive sequestrum, the presence of which was shown by an X-ray taken a few months ago. It was proposed to remove this by operation.

This case, Dr. Coley said, was of the greatest interest, as he believed it to be the only case of periosteal sarcoma of the femur, with metastases, that had ever been cured by any form of treatment. Periosteal sarcoma of the femur was known to be the most fatal of all types of sarcoma, and only a few cases had lived beyond three years after hip-joint amputation. This patient was now well for nine and one-half years and could be fairly regarded as cured.[1]

[1] About three weeks after showing this patient at the meeting of the New York Surgical Society, Dr. Coley noticed a small tumor in the pectoral region, apparently starting from the skin in the area formerly occupied by a large metastatic tumor for which X-ray treatment had been given for a number of weeks prior to operation in 1903. This was removed

EXOPHTHALMIC GOITRE; PRELIMINARY LIGATION; UNILATERAL THYROIDECTOMY; CURE LASTING FOUR YEARS.

DR. CLARENCE A. MCWILLIAMS presented a girl of thirteen years, who was admitted to the Yonkers Hospital in January, 1908, with symptoms typical of marked chorea. Three weeks later, symptoms of Graves's disease began to develop, gradually becoming more severe. Her pulse ranged between 120 and 140, there was exophthalmus, the thyroid was enlarged and tender, and the child was excessively nervous. The Rogers and Beebe serum was ordered, and five injections given without beneficial result.

When Dr. McWilliams first saw the patient, on August 4, 1908, seven months after her admission to the hospital, the girl was very thin and emaciated, and there was marked symmetrical exophthalmus of both eyes. There was a slight, symmetrical enlargement of the thyroid, the pulse was rapid (130 to 140), and there was a systolic murmur at the apex. The nervousness and choreic twitchings were intense. A blood examination was made, which showed the changes proven by Kocher to be characteristic of Graves's disease, with 42 per cent. of polymorphonuclear leucocytes and 56 per cent. of lymphocytes. The blood-pressure was 134 mm.

Operation seemed to be the only means of speedy relief and to prevent further vascular changes. To perform the classical partial thyroidectomy at one sitting was deemed extremely hazardous, in view of the poor general condition of the patient, so the plan advocated by Kocher of doing the operation in stages was adopted. The right superior thyroid vessels were tied on August 5, 1908, using local anæsthesia with a one-eighth per cent. solution of novocaine, combined with adrenalin, and without the preliminary use of morphine. No symptoms resulted from this procedure, nor was there any improvement in her condition, as was to be expected. Accordingly, ten days later, the left superior thyroid vessels were similarly ligated, under the same local anæsthetic. She immediately began to improve, mentally and physi-

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and submitted to Dr. James Ewing, who pronounced it to be an epithelioma. It was primary, and had nothing to do with the sarcoma of the femur.

This, Dr. Coley said, added still further to the interest of this remarkable case, as it was one of the few instances in which a sarcoma and a carcinoma had occurred in the same individual.

cally, and in seven weeks she had gained sixteen pounds in weight. The choreic movements entirely ceased, she became less nervous, her appetite improved, and she slept well. After about eight weeks, the improvement seemed to come to a standstill, and the pulse remained at 110. Accordingly, 54 days after the second operation, the right lobe and part of the isthmus were removed under novocaine local anæsthesia. The two previous operations of ligation of the superior thyroid vessels had improved her general condition to such an extent that a general anæsthetic might have been fairly safe; still, it was felt that it was better to eliminate that danger, if possible. The youth of the patient, however, rendered the question of the painless application of the local anæsthetic problematical. She was first given a hypodermic of a quarter of a grain of morphine. The method of the introduction of the anæsthetic was that which Dr. McWilliams had seen Riedel use. It consisted in inserting a long needle attached to a large glass syringe at the mid-edge of one sternomastoid into the subcutaneous tissue, the solution being forced in until there was a marked swelling. The needle was then gradually carried across the front of the neck to the opposite side, injecting the solution in its progress. It was then withdrawn almost to the point of entry, and inserted deeper, an endeavor being made to get beneath the deep fascia of the neck. It was then pushed inward and upward along the front of the upper surface of the thyroid gland to the opposite side. It was then again nearly withdrawn, and again carried across the front of the lower portion of the thyroid. In this way, the entire front of the capsule of the gland was bathed in the solution, while in addition the cutaneous cervical nerves were rendered insensitive. The thyroid might then be exposed without any pain whatsoever. The landmarks, however, were to some extent obscured by the gelatinous condition of the tissues, but this soon disappeared. Manipulation of the posterior part of the capsule, the clamping of some of the vessels, and particularly dragging upon them, were apt to be accompanied by some pain, presumably due to the vagus nerve supply, and at this stage of the operation it might be advisable to administer nitrous oxide or a few drops of ether to complete the extirpation, but in this particular case this did not become necessary.

The convalescence of this patient after the removal of one lobe and part of the isthmus was uneventful. The highest post-operative temperature was 103°. On the eighth day the pulse

had dropped to 74, and the blood-pressure was 95 mm. Fifty-two days after the final operation the polymorphonuclears had increased from 42 per cent. to 81 per cent., while the lymphocytes had dropped from 56 per cent. to 13 per cent. The blood-pressure at this time was 110 mm. Four months after the operation the patient was apparently enjoying perfect health. The pulse was 78, the exophthalmus had disappeared, and there was no nervousness nor tremor. An examination of the blood showed the total number of leucocytes to be 10,000; the polymorphonuclears were 74 per cent. and the lymphocytes 26 per cent.

At the present time, almost four years after the operation, the girl is perfectly well. At the time of the operation she was a hopeless hospital inmate, her family refusing to take her home. Her exhaustion and emaciation were extreme. The tremor and choreic twitchings were incessant, so that she could not write and could scarcely feed herself. To-day, the only disquieting symptom that could be found is a relative lymphocytosis, an examination of the blood on May 2, 1912, showing 5,340,000 red cells, 4000 white cells, hæmoglobin 104 per cent., color index 1.4 per cent., normal coagulability, polymorphonuclear neutrophiles 43.5 per cent., lymphocytes 52 per cent., chiefly small.

Dr. McWilliams said he had recently been told by Dr. Charles Mayo that after tying the superior thyroids he waited three months before doing a thyroidectomy.

This case, the speaker said, rather militated against Dr. Rogers's theory that one should not remove a part of the gland when it was symmetrically enlarged throughout, because he believed that it would do no good and might produce hypothyroidism. In this instance it had produced a cure, and there was no evidence whatsoever of any hypothyroidism. That the patient could bear an additional burden was shown by the fact that last winter she had a severe suppurative mastoiditis, for which she was successfully operated upon without producing any of her previous hyperthyroid symptoms.

EXOPHTHALMIC GOITRE; PRELIMINARY LIGATION; UNILATERAL THYROIDECTOMY; IMPROVEMENT LASTING THREE YEARS.

Dr. McWilliams also presented a woman, 37 years old, who was admitted to the hospital in May, 1909, with the history that she had always been nervous, but that for the preceding eight

months her condition had grown much worse. She was excitable and began to complain of palpitation and sweating. Her eyes became prominent, and she noticed that the thyroid was larger than before. She had lost strength, and her tremor was so marked that she could scarcely write. Her weight had become reduced from 146 to 118 pounds. Her pulse ranged between 118 and 124.

On admission to the hospital, there was marked bilateral exophthalmus, and a scarcely palpable goitre. The pulse was 120; heart and urine normal. A blood examination showed 6400 white cells, polymorphonuclears 60 per cent. and lymphocytes 31 per cent. On May 15, 1909, the right superior thyroid vessels were tied, an attempt being made to do the operation under the local use of novocaine and adrenalin, but the patient became so tearful and hysterical that she was given a few drops of ether. Seven days after this operation the leucocytes were 5000, the polynuclears 48 per cent., and the lymphocytes 42 per cent. The only effect obtained, apparently, from tying one set of superior thyroids was an increase in the lymphocytosis. Twelve days later the left superior thyroids were tied under gas and ether anæsthesia, and eight days after this the polynuclears had increased to 55 per cent., and the lymphocytes diminished to 37 per cent. There was no appreciable difference in the patient's physical condition after these operations, and eleven days after tying the left superior thyroids the right half of the thyroid was removed, using gas and ether as anæsthetics. There was no evidence of hyperthyroidism whatsoever after this operation, and the patient made a perfect convalescence. Eleven days after this operation the polynuclears were 58 per cent. and the leucocytes 36 per cent. On the twelfth day she went home, with a pulse of 80 and feeling much less nervous. Since then she had been kept under observation, and her pulse had remained between 75 and 80. There had been a considerable improvement in the exophthalmus, but her eyes had never become normal in appearance. She slept and ate well, and had gained much weight, but she still complained of being nervous. It had been suggested that this symptom might be cured by tying the left inferior thyroid, but the patient was very well satisfied with her present condition. She had a badly lacerated perineum, producing backaches, and she attributed her

nervousness to this condition. The question came up as to the advisability of doing a perineorrhaphy on this patient. Personally, Dr. McWilliams thought that we could not be too careful about operating on patients with Graves's disease, and ether seemed to have a very bad effect upon them. He recalled one fatal case in his own practice where the patient died of hyperthyroidism on the third day after tying both superior thyroids at the same sitting, under ether, and he knew of two similar cases in the hands of other surgeons. He believed it to be far safer to tie one superior thyroid under a local anæsthetic, and then, at a second sitting, tie the opposite one, also under local anæsthesia. Then an interval of at least two months should be allowed to elapse before removing one lobe. He believed that we should try to do this operation under a local anæsthetic, giving a preliminary injection of scopolamine and morphine. The gland could be isolated without much difficulty, and when the deep dissection was reached, if this proved painful, the operation could be completed under nitrous oxide. Kocher had recently told him that it was exceptional for him to be able to do a thyroidectomy in an American under a local anæsthetic. The same was true of Italians. In all other nationalities he was able to use a local anæsthetic in removing the gland.

A blood examination in this case, made May 8, 1912, showed 5,248,000 red cells, 14,600 white cells, 82 per cent. of hæmoglobin, 50 per cent. of polynuclears, and 46 per cent. of lymphocytes. Here again we had a slight relative lymphocytosis.

Dr. John Rogers said the first case shown by Dr. McWilliams was an excellent example of a so-called cure by partial thyroidectomy in which the pulse and various vasomotor disturbances had subsided, but where there was at present a very high blood-pressure. That patient could doubtless be further improved by the administration of adrenal nucleoprotein or the part of the adrenal which contains no epinephrin. If these cases were left alone, they usually terminated in nephritis, with general anasarca or from some obscure heart lesion. The patient was still very young, and it would be interesting to watch the future outcome of the case.

SPIKED HIP FRACTURE; UNION WITH SHORTENING.

Dr. Robert T. Morris presented a man aged 69 years, who had a complicated transverse fracture of the neck of the femur, together with apparent impaction of the distal fragments. He

was treated for five weeks with splints, in bed, in the hope that the impaction of the fragments might be sufficient to secure union. As this failed to occur in the intracapsular portion, an open operation was done by Dr. Morris, and the fracture was spiked with a nail which had been allowed to remain *in situ*.

Bony union followed, and the patient was now beginning to walk. There was about two inches shortening, apparently due to impaction of the distal fragment of the neck sunken into the shaft to that extent.

FRACTURE OF THE TIBIA PINNED WITH THE AID OF THE FLUOROSCOPIC SCREEN.

DR. MORRIS presented a patient who had a spiroid fracture of the tibia which was pinned according to the method which the author had described in an article published in the *Journal of the American Medical Association*, October 21, 1911, using the fluoroscopic screen for guidance in the introduction of a silver pin through a cannula into a drill hole traversing both fragments, the pin being left in permanently. The operation was done under cocaine anæsthesia, which proved perfectly satisfactory. Dr. Morris said that with the aid of the fluoroscope and under local anæsthesia, many fractures could be pinned in a simple and effective way.

FISTULÆ ASSOCIATED WITH RENAL CALCULUS.

DR. MORRIS presented a man who gave a history of having fallen, injuring the right loin. A year later, an abscess developed at the right costal margin, but it was not attributed at the time to his former loin injury, and a surgeon who opened the abscess removed part of a rib under the impression that the abscess was due to necrosis of the rib.

When Dr. Morris first saw the patient, about a year afterward, he had what appeared to be a sinus associated with necrosis of the costal cartilage. After curetting the walls of the cavity, Beck's paste was injected, with the result that it unexpectedly appeared in the bladder. Collargol was then injected for the purpose of taking a radiograph, and some of the collargol was promptly expectorated by the patient, and at the same time some was passed *per urethram*. The patient thus had a complete sys-

tem of canals extending between his mouth and his meatus urinarius.

The collargol obscured the real cause of the patient's trouble. This was found to be a renal calculus which had escaped from the pelvis of the kidney into an abscess cavity. A trap-door of the abdominal wall was turned down by Dr. Morris and the calculus found and removed. The patient was now practically well.

The reason why no urine had escaped from the fistula which allowed collargol to extend to the mouth and to the urinary bladder was that the kidney had been practically destroyed at the time of the original injury, the calculus probably subsequently forming about a blood-clot.

ADENOCARCINOMA OF THE CÆCUM; EXCISION AND LATERAL ANASTOMOSIS.

DR. BENJAMIN T. TILTON presented a man, 48 years old, whose father had died of cancer at the age of 65. Nine months prior to his admission to the hospital, the patient began to suffer from pain in the right side of the abdomen, radiating upward and into the lumbar region. He was slightly constipated. He had never noticed any blood in the stools and there was no perceptible loss of flesh. A few weeks before coming to the hospital he had noticed a tumor in the right iliac region; this gradually increased in size.

Operation, March 20, 1912: Upon opening the abdomen over the tumor, the omentum was found adherent over a growth about the size of a child's head. This occupied the region of the cæcum, and with considerable difficulty it was freed from its connection with the parietal peritoneum and the iliac fossa, and the mesentery tied off. The ascending colon was divided between clamps, the distal end closed with Pagenstecher thread, and the lower ileum likewise divided, closing the proximal end. A side-to-side anastomosis was then made by means of clamps between the ileum and the transverse colon.

The patient made an excellent recovery and had regained his weight and strength. Examination of the tumor showed that the mucous membrane of the cæcum was not involved. It was freely movable over the growth, and showed no evidence of ulceration. Its lumen was only slightly constricted. Microscopically, the tumor proved to be an adenocarcinoma.

BENIGN TUMOR OF THE PYLORUS; POSTERIOR GASTRO-ENTEROSTOMY.

DR. TILTON presented a man, 39 years old, who eight years ago began to suffer from pain in the epigastrium, with occasional vomiting. He had never vomited blood nor noticed blood in his stools. Five weeks prior to his admission to the hospital he began to vomit everything that he ate; the vomiting would occur any time from fifteen minutes to an hour after eating, and the vomitus sometimes had a coffee-ground appearance. He suffered from a constant eructation of gas, and pyrosis, and had lost about 40 pounds during the past five weeks.

Physical examination on admission revealed a movable tumor, about the size of a small grape-fruit, located in the region of the pylorus. The stomach was dilated, and an analysis of its contents revealed free hydrochloric acid; no lactic acid and no blood. The patient was much emaciated and vomited constantly on taking food.

Operation, August 16, 1911: Upon opening the abdomen, the pyloric tumor was found to be smooth in outline, without adhesions or secondary nodules. A posterior no-loop gastro-enterostomy was done, with clamps. The patient made an excellent recovery, and had not vomited since the operation. He could eat anything without digestive disturbance; he had regained the 40 pounds that he had lost, and had resumed his work as a baggageman. The tumor had entirely disappeared, and had evidently been due to inflammatory thickening about a chronic gastric ulcer.

DR. TILTON presented a second patient, a man of 40, who ten years prior to his admission to the hospital had begun to suffer from pain in the epigastrium, radiating to both sides. The pain usually came on about two hours after eating, and lasted several hours; it was intermittent in character, and was not accompanied by vomiting, eructations, or pyrosis. Six weeks before admission he began to suffer for the first time from vomiting and sour eructations. The vomiting increased in frequency, and he lost 25 pounds in weight during the six weeks preceding his entrance to the hospital.

Upon examination, it was found that the lower border of the stomach extended to one-fourth of the distance between the umbilicus and the symphysis. The gastric analysis showed free hydrochloric acid and no lactic acid. The patient was very much emaciated.

Operation, May 18, 1909: The stomach was found to be markedly dilated, and the pylorus was the seat of an inflammatory tumor. A posterior, no-loop gastro-enterostomy was done with the Moynihan clamps. The vomiting ceased immediately after the operation, and the patient soon regained his lost weight. His recovery was uneventful and he was entirely free from digestive disturbances. No tumor could now be felt.

MEDIASTINOTOMY.

Dr. Willy Meyer stated that within the past year two cases of large, incurable tumors of the anterior mediastinum had come under his care, having been sent to him for operation. The first, a woman 40 years old, had been in another hospital for several months on account of increasing difficulty in breathing, and both pleural cavities had been repeatedly aspirated, large quantities of fluid being withdrawn. When she came under Dr. Meyer's observation, she was obliged to sit up day and night, the recumbent posture producing intense difficulty in breathing. All her symptoms pointed to compression of the superior vena cava. Threatening cyanosis made another tapping of both pleural cavities imperative, and more than a quart of fluid was withdrawn from either side. The patient was then allowed to return to her sitting posture, and a few hours later she suddenly expired. A post-mortem was refused.

The second patient, a woman 22 years old, also suffered from pronounced cyanosis, with œdema of the right breast and arm, and marked tenderness over the body of the sternum. Her symptoms had gradually increased during the past six months, and her difficulty in breathing was now so pronounced that she was obliged to sleep in the sitting posture. An X-ray was taken, which showed a shadow on the right and left sides of the sternum, in the upper portion of the chest.

A diagnosis of tumor of the anterior mediastinum was made, and although a radical operation seemed impossible, it was deemed wise to try to improve the patient's condition by decompression of the anterior mediastinum. On January 10, 1912, the patient was placed in a reversed Trendelenburg posture, with the pelvis low and the head raised, and under superficial nitrous oxide-oxygen anæsthesia the upper two-thirds of the sternum and the cartilages of the superior four ribs were resected. On the left side the pleural cavity was opened, and a low differential pressure

in the negative chamber started. A large infiltrating tumor was found lying in and behind the sternum, and extending up alongside of both venæ innominatæ, especially the right. The patient apparently stood the operation well up to this point, but while applying the dressings she suddenly expired.

Dr. Meyer said he considered these cases especially dangerous, both for tapping and for operation. He was interested in learning recently that Sauerbruch favored positive pressure for these operations.

Regarding other methods of mediastinotomy, the speaker referred to the transverse division of the sternum done by Wilms, in the fourth intercostal space, by Friedreich in the second intercostal space, and that proposed by Sauerbruch a few months ago, consisting in a longitudinal splitting of the sternum with an oblique exit in the fourth intercostal space on the right or left side.

In connection with these cases, Dr. Meyer showed a dog on which he had done Sauerbruch's operation. The incision was made from the cricoid cartilage down over the sternum, meeting the fourth intercostal space on the right side. The jugulum was reached, and the left finger introduced behind the sternum. The internal mammary artery was then doubly ligated and divided in the fourth intercostal space, and the right forefinger gently introduced behind the sternum, until both fingers met, in this way bluntly pushing off the important structures from the posterior side of the sternum. A transverse incision was then made from the fourth intercostal space to the sternum up to the middle line, and the bone divided longitudinally with Gigli's saw. The two halves of the sternum could then be well separated with sharp retractors, and a wide access was gained to the anterior mediastinum.

Dr. Meyer said that in dogs the anatomical condition of the sternum made this operation a more delicate one than in the human being. In the dog, in this instance, the left pleural cavity was unavoidably opened widely. In closing the wound, the narrow condition of the sternum necessitated three silk sutures, embracing the entire bone from one intercostal space to the other. Under differential pressure, the wound was then entirely closed and the animal made a good recovery.

To reach the structures in the upper mediastinum, it seemed that Sauerbruch's method was the preferable procedure.

RESECTION OF THE STOMACH FOR CARCINOMA.

Dr. Meyer presented a man, 56 years old, who was operated on for a large, palpable tumor in the epigastric region sixteen days before at the German Hospital. A tumor was found involving the lesser curvature and the pylorus, with extensive infiltration of the glands, especially in the major omentum, which was attached to the head of the pancreas. The dissection was started at this point to ascertain if the case was operable, and it was found that the glandular tumor could be removed. The operation was rendered difficult by the involved glands in the lesser omentum, reaching well up toward the cardia. After free exposure of the stomach and duodenum, Dr. Meyer used Hyjotl's surgical stitching machine, which he had recently demonstrated at a meeting of the Surgical Section of the New York Academy of Medicine. The speaker said that while he was fully convinced that surgeons generally would continue to use needle and thread for their operations on the stomach, still he thought that in weak patients, where time was an important element and where the surgeon might otherwise refrain from radical work, the instrument might be of value. With this stitching machine, two parallel lines of metal sutures were inserted through the stomach and duodenum in a few seconds, leaving a perfectly dry field after division between the same. Of course, an inverting suture was then necessary.

In the case presented by Dr. Meyer, there was still some spurting from the proximal side of the stomach, although both superior and inferior arteries had been ligated. A running suture was put in for safety's sake before the inversion was accomplished, and then a posterior gastro-enterostomy with the button was added. The patient made a good recovery and was out of bed on the fifth day.

Dr. Meyer said he had found it of advantage in a number of instances of resection of the stomach to stitch the head of the pancreas upon the stump of the duodenum for the sake of greater safety.

ACUTE SUPPURATIVE TENOSYNOVITIS OF THE FLEXOR LONGUS POLLICIS.

Dr. William Darrach presented a boy, eight and a half years old, who came to the Roosevelt Hospital on February 10, 1912,

with the history that four days previously he had run a nail into his left hand, opposite the os magnum. Twelve hours after the injury he was awakened by a pain in his hand, and was quite feverish. He was seen by a physician, who dressed the wound daily until the day of his admission to the hospital. At that time, the entire palm was swollen, red, hot, and very tender, the redness, heat, and tenderness extending up the anterior surface of the forearm for about two and a half inches. The symptoms were more marked on the radial side than on the ulnar, and especially so over the region of the flexor longus pollicis tendon. The fingers and thumb were held in a semiflexed position, and passive motion was extremely painful in the thumb; slightly so in the fingers. The dorsum of the hand was red, swollen, and œdematous. The boy's temperature, on admission, was 98.6°; pulse, 88; respirations, 28. His blood count showed 19,000 leucocytes, with 84 per cent. of polymorphonuclears.

Under ether, a one-inch incision was made in the median line, just above the wrist, and this was extended downward through the deep fascia. With a dry field the sheath of the flexors of the fingers was exposed and found to be normal. The sheath of the flexor longus pollicis was then exposed, and was seen to contain pus. It was opened, and a folded rubber tissue drain inserted well down beneath the annular ligament. A second incision was then made over the metacarpal portion of the tendon, the line of this incision being along the *lower* margin of the flexor brevis pollicis. Pus was again found, and a small, soft, split rubber tube was inserted well up toward the annular ligament. A third incision was made over the tendon as it crossed the proximal phalanx, and a rubber tissue drain inserted here. Emphasis was laid by Dr. Darrach on the site of the second incision, as by this route no damage was done to the short thumb muscles or their nerve supply, as was the case with the higher incision. The drains were removed on the fifth day. The distal wounds healed by the tenth day, but the upper wound did not close for eight weeks. At the end of three weeks there was good motion in the two proximal joints, but motion in the terminal joint did not appear until seven weeks had elapsed. It was now perfect. Culture from the wound showed a Gram positive streptococcus.

Dr. A. S. Vosburgh, after referring to the good result obtained in the case shown by Dr. Darrach, said that in the past suppurative processes about the hand had been, as a rule, most

barbarously treated, and it was a relief to see a case of this kind, which was treated along anatomical lines, with an early recognition of the site of the pus and its prompt and thorough removal. The incision advocated by Dr. Darrach along the lower margin of the flexor brevis pollicis was very similar to the one advised by Kirmisson.

In abscess of the thumb region, where the radial bursa is involved, the thumb-web no longer presents an anteroposterior surface, the free margin of the web in the interdigital cleft becomes flat or rounded.

Here the radial bursa, Kirmisson recommends, should be entered by an incision parallel with the free margin of the web, opening into the cellular space between the first dorsal interosseous and the adductor transversus pollicis. Less damage is done by this incision.

FORWARD DISLOCATION AT THE INFERIOR RADIO-ULNAR JOINT, WITH FRACTURE OF THE LOWER THIRD OF THE SHAFT OF THE RADIUS.

Dr. William Darrach presented a man, 20 years old, who was admitted to the Roosevelt Hospital on September 15, 1910. He gave the history that eight weeks ago, while cranking an automobile, he got a back kick, the crank handle not slipping from his hand. He was seen almost immediately by a physician, who made a diagnosis of fracture of the lower radius, and "set" the injured arm. An X-ray was taken three days later, which showed some anterior bowing at the radial break, and a pad was inserted in front of this point. He wore an anterior wooden splint from the elbow to the base of his fingers, and a posterior one which was slightly shorter. At the end of five weeks there was almost no motion at the wrist and very little in the fingers. Massage was begun, but at the end of three more weeks there was almost no improvement.

When the patient was seen by Dr. Darrach there was a firm, hard swelling beneath the flexor tendons, just above the palmar crease, apparently the head of the ulna. The forearm was held in the position of 45 degrees of supination; there was not more than 10 degrees of flexion and extension at the wrist, and motion at the fingers was practically *nil*. There were no symptoms referable to pressure on the median or ulnar nerves. The X-rays showed a fracture of the radial shaft about two and a half inches

above the lower margin, with some anterior bowing. The head of the ulna was displaced forward.

The following day, after an unsuccessful attempt to reduce the dislocation, an incision was made over the anterior aspect of the head of the ulna. It was found firmly imbedded in new tissue, and the old opening into the joint was freed with some difficulty. By firm pronation, with pressure over the ulnar head, the latter was finally made to enter the joint cavity and the remains of the anterior ligament were sewn in place with chromic catgut. The skin was then closed with silk and a dry dressing and plaster bandage applied. An X-ray, taken on the third day, showed the head of the ulna in place and the anterior bowing of the radius partly overcome. After union had occurred, a shorter splint was applied and massage of the fingers begun. Three weeks later the cast was removed. The fingers could now be flexed to two-thirds their normal extent, with 45 degrees of flexion at the wrist, and ten degrees of extension. The forearm was held in extreme pronation, with only ten degrees of supination from this position. Two and a half months later the fingers had almost completely regained their normal range; flexion at the wrist was ten degrees short of normal; extension 155 to 180 degrees; very little supination. The grip and finger motions were normal. The patient was able to play the piano as well as he could before the injury. He complained of inability to supinate, and discussed the possibility of an ostectomy of the head of the ulna.

ANTERIOR DISLOCATION OF THE HEAD OF THE ULNA.

DR. DARRACH presented a man, 34 years old, who was admitted to the Roosevelt Hospital on July 25, 1911, with the history that six and a half weeks before admission he had caught his left hand in a machinery belt, twisting it in extreme pronation. He went to a hospital, where an X-ray was taken and he was told that his wrist was all right. Since the injury he had been unable to work because of pain and limitation of motion.

On examination, the head of the ulna could be felt half an inch above the palmar crease in the mid-line. Pronation and supination were limited to one-third their normal range; adduction was somewhat increased; extension was normal, and flexion was limited to one-half. There was considerable limitation of motion in all of the fingers. No change of sensation in either the median or ulnar distribution.

On the following day an unsuccessful attempt was made to reduce the dislocation, although the X-ray showed that the ulna had been crowded in somewhat. On July 27, 1911, under gas and ether anæsthesia, the lower inch of the ulna was removed subperiosteally, the styloid process, which had been broken off, being left behind. Massage and passive motion were begun at the end of two weeks. At the expiration of five weeks motions were completely restored, and the man returned to his work.

Dr. Darrach said the partial ostectomy was done because of his experience in a previous case, where an open reduction was done at the end of eight weeks for a similar condition, and the result showed almost no pronation or supination at the end of a year and a half. The result in this second case seemed to justify the osteotomy in late cases, where a closed reduction had proved unsuccessful. X-ray pictures taken at intervals since the operation showed a regeneration of the lower end of the bone.

ACUTE DIFFUSE PERITONITIS FROM RUPTURED ABSCESS OF RIEDEL'S LOBE OF THE LIVER.

Dr. William Darrach presented a man, 42 years old, who was admitted to the Roosevelt Hospital on October 4, 1910, complaining of severe abdominal pain. His past history, barring diseases of childhood, was entirely negative, excepting that one year before he had received a heavy blow over the right upper abdominal quadrant. For two months prior to his admission he had complained of a poor appetite, with moderate prostration, and a persistent dull pain in the right upper quadrant. There had been no diarrhœa nor constipation, nor had there been vomiting or nausea or colicky pains until the morning of his admission, when the dull pain suddenly became very sharp and stabbing in character, doubling him up. He was very much nauseated, but could not vomit, and the gagging caused excruciating pain.

On admission, the patient looked acutely ill. His abdomen showed a marked general rigidity, being almost board-like on the right side beyond the nipple line. The liver dulness extended from the fifth space to three inches below the costal margin. His temperature on admission was 101°; pulse, 96, small and thready; respirations, 24. The blood count showed 11,800 leucocytes, with 69 per cent. of polymorphonuclears.

The patient was operated on under gas and ether, four hours after the onset of his pain. When under the influence of the

anæsthetic, a mass, the size of a goose egg, could be felt midway between the costal margin and the crest of the ilium in the anterior axillary line; its anterior and lower margins were distinct, but the upper margin could not be clearly made out. There was a distinct zone of tympany between it and the liver dulness. A high intermuscular incision was made. The peritoneum was markedly œdematous, and a large quantity of turbid fluid was found on opening the cavity. The appendix was delivered through the wound, and was found to be normal. A firm mass was felt lying just above the incision, and upon enlarging the latter, the mass proved to be a distended Riedel's lobe, and upon aspiration, a thick, salmon-colored pus was evacuated. The mass was then incised, and about three ounces of pus removed. An opening from this cavity was found on the under surface of the liver, where it had ruptured into the general peritoneal cavity. Cigarette drains were inserted into the abscess and into the general cavity opposite the site of rupture. The abdominal cavity was then washed out with a Blake irrigator.

The patient's temperature fell to normal immediately after the operation, and remained so throughout the period of his convalescence. Excepting for two days of moderately severe vomiting, there were no untoward symptoms, and he was discharged on the twenty-fifth day with a small granulating wound. Cultures taken from the abscess cavity and the peritoneal fluid were both sterile.

POST-OPERATIVE TETANY: PARATHYROID TRANSPLANTATION.

Dr. Eugene H. Pool and Dr. P. R. Turnure presented a woman, 22 years old, whose general health had always been good, who had been subjected to two operations for goitre in Europe, five and eight years ago, respectively, but enlargement of the right lobe had made further surgical intervention necessary. On February 1, 1912, she was operated on by Dr. A. B. Johnson, the right lobe of the thyroid being removed *in toto*, the isthmus only being left. Both the superior and inferior thyroid arteries of the right side were ligated. The left lobe of the gland had evidently been excised at a previous operation, as this side presented nothing but scar tissue. The two parathyroids on the left side had likewise presumably been removed, otherwise, tetany could scarcely have followed this last operation.

The healing of the wound was uncomplicated. On the third

day after the operation tonic contractures occurred, with cramp-like pains in the fingers and hands, which assumed the position known as accoucheur's hand. Cramp-like pains also occurred in the calves of the legs. On the fourth day there were painful tonic contractures of the fingers of the left hand which lasted from nine o'clock in the evening until one o'clock the following morning. Calcium lactate (36 grains) was given hypodermatically.

On the following day, when Dr. Pool first saw the patient, there was marked hypersensitiveness of the motor nerves, as evidenced by electrical (Erb's) and other tests (Trousseau's, chrostitis, leg and arm). Forty grains of calcium lactate had been given by mouth.

On the sixth day, Dr. Pool very carefully dissected out a parathyroid from a young man on whom he was operating for goitre. Immediately upon its removal, the parathyroid was immersed in Locke's solution, and kept at body temperature. The patient with tetany was then anæsthetized, and Dr. Turnure made a bloodless pocket in the properitoneal tissue behind the right rectus sheath, half way between the ensiform and the umbilicus, and about one inch from the median line. He carefully incised the parathyroid before placing it in the pocket, manipulation and exposure to the air being reduced to a minimum. The implantation was completed about half an hour after the removal of the gland. The wound healed by primary union.

On the seventh day there were forcible contractures, with severe pains in the parts affected, the symptoms being especially pronounced during the night. The elbows were flexed at a right angle, likewise the wrists and fingers were forcibly flexed. The attack lasted five hours. Since then the patient had remained free from symptoms of tetany, though she presented some evidences of deficiency of thyroid.

In speaking of this case, Dr. Pool said the value of the parathyroid graft must remain conjectural, and that only its removal, which had not been deemed advisable, could demonstrate the real effect of the transplant. Three interpretations suggested themselves: First, that the graft exerted no influence. It was possible that the attack of tetany was of a mild type and destined to run a short course, and that the parathyroid implantation happened to precede by a short time the disappearance of the symptoms. Second, the graft may have exerted a temporary effect during its absorption in tiding over a transitory attack of tetany while in-

jured or devascularized parathyroids were rehabilitating themselves. Third, it was possible that the transplanted parathyroid had been permanently effective as a functionating graft, although the early improvement after the implantation did not favor that assumption.

Dr. Pool said the two doses of calcium lactate produced a marked effect upon the symptoms as well as upon the electrical excitability of the ulnar nerve. Of the various tests that had been employed, Erb's was undoubtedly the most reliable and accurate for tetany. It should always be used in a suspected case, as it gave an accurate indication of motor excitability, and rendered it possible to check daily changes in the excitability, thus affording a real indication of the progress of the disease and the effect of therapeutic measures. While all of the electrical reactions were low, the greatest significance should be attached to a low kathodal opening current.

In regard to the other tests Dr. Pool stated that from the experience in this case and a previous case the leg test appears as simple of application as Trousseau's sign, and more sensitive and reliable. In the present case it was obtained after Trousseau's sign failed to elicit a response. He stated that the leg test like Trousseau's sign is dependent upon the hyperexcitability of the motor nerves, but the two tests differ as to the method of demonstrating this hyperexcitability, in Trousseau's test the nerve being compressed; in the leg test, the nerve being stretched.

Dr. Pool said this case was shown, first, because the symptoms disappeared after parathyroid transplantation; and, second, because it offered an opportunity to study the characteristic phenomena of tetany dependent upon the irritability of the motor nerves.

Dr. Morris said he thought the theory suggested by Dr. Pool was tenable, and that the transplanted parathyroid might bridge over a period during which the remnant of the patient's own gland was inactive. It was rare, the speaker said, to find an individual in whom a heteroplastic transplantation of tissue of any sort proved successful, and this was the stumbling-block that hindered work in this direction. It was due to the fundamental intolerance of the tissues of one individual for the tissues of another individual.

Dr. Rogers said Cristiani had practically proven that the transplantation of the graft in these cases must be done within

three minutes. In the case shown by Dr. Pool and Dr. Turnure, it seemed surprising that the graft should live, but one could not say that it did not. The only way to prove it would be by operation. The patient showed pronounced evidences of myxœdema, and certainly seemed to be an excellent subject for thyroid grafting.

RUPTURE OF THE BLADDER.

DR. P. R. TURNURE presented a man who was admitted to the service of Dr. F. W. Murray at the House of Relief on January 29, 1912. The history obtained was that on the day of his admission he had drunk a considerable amount of beer, and at 7 P.M. he found that he was unable to pass water, although five hours prior to that he had passed his urine normally. His desire to urinate increased, and as he began to suffer from abdominal pain, he was brought to the hospital in an ambulance at 8.15 P.M.

Upon admission, he appeared to be slightly intoxicated and suffering much pain. He denied having sustained any injury whatever, and was certain that he could remember everything that happened to him. Physical examination showed a moderately rigid abdomen, with marked tenderness over the bladder region, and slight tenderness over the right kidney. No free fluid could be made out. He was at once catheterized, and eight ounces of bloody urine withdrawn. He felt immediate relief and was comfortable until eleven o'clock that night, when he had a desire to urinate. He was again catheterized, and 48 ounces of blood-tinged urine withdrawn, the amount of blood being much less than that contained in the first specimen.

On the following day the patient felt much more comfortable, although his inability to urinate persisted, and he had to have his water drawn three times, about 50 ounces being obtained during the day. The quantity of blood in the urine was steadily decreasing, and the temperature, pulse, and respirations were normal. There were slight signs of an inflammatory process in the region of the right kidney, and arrangements were made to have him cystoscoped the next day. The bladder was also tested by injecting ten ounces of saline solution, all of which was withdrawn. The blood count was normal.

The following day the patient was catheterized twice in the morning, twelve ounces of slightly blood-tinged urine being withdrawn. At two o'clock in the afternoon he began to complain of general abdominal pain; his temperature rose to 101°, and a blood

count showed 25,720 white cells, 7,150,000 red cells, 78 per cent. of hæmoglobin, and 90 per cent. of polymorphonuclears. He rapidly developed signs of a commencing peritonitis, and an immediate operation was decided upon. This was done at five o'clock that afternoon, and a rent in the fundus of the bladder, running in an anteroposterior direction and opening into the peritoneum, was found. It was at least three inches long, and was closed in the usual way, a cigarette drain being inserted into the pelvis and a catheter passed into the bladder through the urethra and left there. As the patient was rather weak, the abdominal wound was closed by through-and-through sutures, and an infusion was given. He was then put in bed in the Fowler position and given the Murphy drip. His recovery was uneventful, and he left the hospital on February 20.

Dr. Turnure said that three points were of interest in this case: first, the misleading history; second, the fact that all the fluid injected into the bladder returned and that the patient was much relieved by catheterization, and the rapidly diminishing amount of blood found in the urine; third, the tolerance of the peritoneum to urine.

Dr. George Woolsey said he had seen two similar cases where there was no apparent cause for the rupture of the bladder. In one of the cases the patient was drunk, and under those circumstances one could not absolutely say that there was no traumatism. Of course it was known that alcohol had an effect on the bladder which rendered it more susceptible to rupture. In his second case, Dr. Woolsey said, where there was a history of alcoholism but no drunkenness, there was an extraperitoneal rupture of the bladder without trauma, the diagnosis being made with the aid of the cystoscope.
